Appendix A: Ground Water Quality Standards (IDAPA 58.01.11.200.1)

Table 1. Primary Constituent Standards.

Chemical Abstract Service Number	Constituent	Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)
7440-36-0	Antimony	0.006	0.003
7440-38-2	Arsenic	0.05**	0.025**
1332-21-4	Asbestos	7 million fibers/l longer than 10 um	3.5 million fibers/l longer than 10 um
7440-39-3	Barium	2	1
7440-41-7	Beryllium	0.004	0.002
7440-43-9	Cadmium	0.005	0.0025
7440-47-3	Chromium	0.1	0.05
7440-50-8	Copper	1.3	0.65
57-12-5	Cyanide	0.2	0.1
16984-48-8	Fluoride	4	2
7439-92-1	Lead	0.015	0.0075
7439-97-6	Mercury	0.002	0.001
*	Nitrate (as N)	10	5***
*	Nitrite (as N)	1	0.5
7782-49-2	Selenium	0.05	0.025
7440-28-0	Thallium	0.002	0.001
15972-60-8	Alachlor	0.002	Detection
1912-24-9	Atrazine	0.003	Detection
71-43-2	Benzene	0.005	Detection
50-32-8	Benzo(a)pyrene (PAH)	0.0002	Detection
75-27-4	Bromodichloromethane (THM)	0.1	Detection
75-25-2	Bromoform (THM)	0.1	Detection
1563-66-2	Carbofuran	0.04	Detection
56-23-5	Carbon Tetrachloride	0.005	Detection
57-74-9	Chlordane	0.002	Detection
124-48-1	Chlorodibromomethane (THM)	0.1	Detection
67-66-3	Chloroform (THM)	0.002	Detection
94-75-7	2,4-D	0.07	Detection
75-99-0	Dalapon	0.2	Detection
103-23-1	Di (2-ethylhexyl) adipate	0.4	Detection
96-12-8	Dibromochloropropane	0.0002	Detection
541-73-1	Dichlorobenzene m-	0.6	Detection
95-50-1	Dichlorobenzene o-	0.6	Detection
106-46-7	1,4(para)-Dichlorobenzene or Dichlorobenzene p-	0.075	Detection
107-06-2	1,2-Dichloroethane	0.005	Detection
75-35-4	1,1-Dichloroethylene	0.007	Detection
156-59-2	cis-1, 2-Dichloroethylene	0.07	Detection
156-60-5	trans-1, 2-Dichloroethylene	0.1	Detection
75-09-2	Dichloromethane	0.005	Detection
78-87-5	1,2-Dichloropropane	0.005	Detection
117-81-7	Di (2-ethylhexyl) phthalate	0.006	Detection
88-85-7	Dinoseb	0.007	Detection
85-00-7	Diquat	0.02	Detection
145-73-3	Endothall	0.1	Detection
72-20-8	Endrin	0.002	Detection
100-41-4	Ethylbenzene	0.7	Detection
106-93-4	Ethylene dibromide	0.00005	Detection
1071-83-6	Glyphosate	0.7	Detection
76-44-8	Heptachlor	0.0004	Detection
1024-57-3	Heptachlor epoxide	0.0002	Detection
118-74-1	Hexachlorobenzene	0.001	Detection
77-47-4	Hexachlorocyclopentadiene	0.05	Detection
58-89-9	Lindane	0.0002	Detection

Chemical Abstract Service Number	Constituent	Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)
72-43-5	Methoxychlor	0.04	Detection
108-90-7	Monochlorobenzene	0.1	Detection
23135-22-0	Oxamyl (Vydate)	0.2	Detection
87-86-5	Pentachlorophenol	0.001	Detection
1918-02-1	Picloram	0.5	Detection
1336-36-3	Polychlorinated biphenyls (PCBs)	0.0005	Detection
122-34-9	Simazine	0.004	Detection
100-42-5	Styrene	0.1	Detection
1746-01-6	2,3,7,8-TCDD (Dioxin)	3.0 x 10-8	Detection
127-18-4	Tetrachloroethylene	0.005	Detection
108-88-3	Toluene	1	Detection
*	Total Trihalomethanes [the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform)]	0.1	Detection
8001-35-2	Toxaphene	0.003	Detection
93-72-1	2,4,5-TP (Silvex)	0.05	Detection
120-82-1	1,2,4-Trichlorobenzene	0.07	Detection
71-55-6	1,1,1-Trichloroethane	0.2	Detection
79-00-5	1,1,2-Trichloroethane	0.005	Detection
79-01-6	Trichloroethylene	0.005	Detection
75-01-4	Vinyl Chloride	0.002	Detection
1330-20-7	Xylenes (total)	10	Detection
*	Gross alpha particle activity (including radium -226, but excluding radon and uranium)	15 pCi/l	7.5 pCi/l
*	Combined beta/photon emitters	4 millirems/yr effective dose equivalent	2 millirems/yr effective dose equivalent
*	Combined Radium – 226		
*	and radium 228	5 pCi/l	2.5 pCi/
*	Strontium 90	8 pCi/l	4 pCi/l
*	Tritium	20,000 pCi/l	10,000 pCi/l
*	Total Coliform	1 colony forming unit/100 ml	detection

*No Chemical Abstract Service Number exists for this constituent.

**EPA drinking water standard for arsenic is currently 10 µg/l or 0.01 mg/l.

*** If the analytical result for nitrate is less than half the Ground Water Quality Standard:
- An alert level is not reached and no action is required, if the analytical result is less than 25% above the background level for the area.
- An alert level is reached, and additional monitoring may be required if the analytical result is greater than 25% above the background level for the area.

If the analytical result for nitrate is greater than half the Ground Water Quality Standard:
- An alert level is not reached, and no action is required, if the analytical result is less than 10% above the background level for the area.
- An alert level is reached, and additional monitoring may be required, if the analytical result is greater than 10% above the background level for the area.

Table 2. Secondary and Unclassified Constituent Standards, including common ions, generally based on aesthetic qualities.

Constituent	Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)
Acrolein	0.32	0.16
Aluminum	0.2	0.1
Bicarbonate*	--	--
Calcium*	--	--
Chloride	250	125
Color	15 Color Units	7.5 Color Units
Foaming Agents	0.5	0.25
Iron	0.3	0.15
Magnesium*	--	--
Manganese	0.05	0.025
Odor	3.0 Threshold Odor Number	1.5 Threshold Odor Number
Phosphorous, Total	0.025 mg/l for lakes/0.10 mg/l for streams	
Phosphorous, Ortho	0.025 mg/l for lakes/0.10 mg/l for streams	
pH	≥6.5 to ≤8.5 (no units apply)	<6.5; >8.5
Potassium*	--	--
Silver	0.1	0.05
Sodium*	--	--
Sulfate	250	125
Total Dissolved Solids	500	250
Zinc	*5*	*2.5*

*Common ions or other constituents for which no standard has been developed.

Table 3. Microbial Constituents.

Constituent	Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)
Bacteria		
E. Coli Bacteria*	--	detection
Fecal Coliform*	--	detection
Fecal Streptococcus*	--	detection
Heterotrophic Plate Count (HPC)**	500 colonies/ml	250 colonies/ml
Protozoa		
Cryptosporidium	99% removal	detection
Giardia lamblia	99.9% removal	detection
Viruses	*99.99% removal*	*detection*

*Bacterial constituents for follow-up sampling and analysis upon a positive total coliform result (see Table 1.)
** HPC is used as an indicator of recharge basin filtration efficiency.

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Appendix B: Definitions

Aquifer A geological unit of permeable saturated material capable of yielding economically significant quantities of water to wells or springs.

Beneficial Uses Various uses of ground water in Idaho including, but not limited to, domestic water supplies, industrial water supplies, agricultural water supplies, aquacultural water supplies, and mining. A beneficial use is defined as actual current or projected future uses of ground water.

Best Available Method Any system, process, or method that is available to the public for commercial or private use to minimize the impact of point or nonpoint sources of contamination on ground water quality.

Best Management Practice A practice or combination of practices determined to be the most effective and practical means of preventing or reducing contamination to ground water and interconnected surface water from nonpoint and point sources to achieve water quality goals and protect the beneficial uses of the water.

Best Practical Method Any system, process, or method that is established and in routine use that could be used to minimize the impact of point or nonpoint sources of contamination on ground water quality.

Constituent Any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste or other substance occurring in ground water.

Contaminant Any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste or other substance which does not occur naturally in ground water or which naturally occurs at a lower concentration.

Contamination The direct or indirect introduction into ground water of any contaminant caused in whole or in part by human activities.

Degradation The lowering of ground water quality as measured in a statistically significant and reproducible manner.

Delivery System An existing canal system used for carrying surface water to an infiltration basin.

Ground Water Any water of the state which occurs beneath the surface of the earth in a saturated geological formation of rock or soil.

Ground Water Quality Standard	Values, either numeric or narrative, assigned to any constituent for the purpose of establishing minimum levels of protection.
Infiltration Basin	A natural depression in the earth's surface that may be capable of holding water that is intended to percolate through soils and geologic formations to an aquifer.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of disposal, pollutant removal, or ground water recharge.
Managed Recharge	Management of water specifically for the purpose of adding water to the zone of saturation by land application.
Natural Background Level	The level of any constituent in the ground water within a specified area, as determined by representative measurements of the ground water quality unaffected by human activities.
Projected Future Beneficial Uses	Various uses of ground water, such as drinking water, aquaculture, industrial, mining or agriculture that are practical and achievable in the future based on hydrogeologic conditions, water quality, future land use activities and social/economic considerations.
Qualified Party	An individual or firm with experience in soils, geology, hydrogeology, hydrology or similar field and recognized in Idaho as a Registered Professional Geologist, Engineer or Environmental Health Professional.
Recharge	The process of adding water to the zone of saturation.
Recharge Area	An area in which water infiltrates into the soil or geological formation and percolates to one (1) or more aquifers. For the purpose of this guidance, a recharge area does not include areas with incidental recharge by precipitation, irrigation practices and conveyance system leakage, surface water seepage from creeks, streams or lakes, lagoons, storm water runoff and storage, lagoons associated with confined animal operations, mining operations, wastewater land applications or recharge water applied through the use of injection wells.
Recharge Water	Water that is specifically utilized for the purpose of adding water to the zone of saturation.

Responsible Party	An individual, group, corporation or other entity that is accountable for implementation of the approved ground water quality monitoring plan. The responsible party may be the land owner, the operator, the project manager or the benefactor. The responsible party must be identified in the monitoring plan.

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Appendix C: Acronyms, Web sites, and Units

ASTM	American Society for Testing and Materials	http://www.astm.org
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act. Also known as "Superfund"	http://yosemite.epa.gov/R10/CLEANUP.NSF
DEQ	Idaho Department of Environmental Quality	http://www.deq.state.id.us
EPA	U.S. Environmental Protection Agency	http://epa.gov
FEMA	Federal Emergency Management Agency	http://www.fema.gov/
GIS	Geographic Information System	
IDWR	Idaho Department of Water Resources	http://www.idwr.state.id.us
ISDA	Idaho State Department of Agriculture	http://www.isda.state.id.us
NIWQP	National Irrigation Water Quality Program	http://www.usbr.gov/niwqp
NRCS	Natural Resources Conservation Service	http://www.ncgc.nrcs.usda.gov
RCRA	Resource Conservation and Recovery Act	http://www.epa.gov/enviro/index_java.html
ISCC	Idaho Soil Conservation Commission	http://www.scc.state.id.us/
USACE	U.S. Army Corps of Engineers	http://www.usace.army.mil
USBOR	U.S. Bureau of Reclamation	http://www.usbr.gov
USGS	U.S. Geological Survey	http://www.usgs.gov
	Idaho Surface Water Quality Statewide Network	http://id.water.usgs.gov.public/wq/index.html

mg/l	Milligrams per liter, unit of measure
ml	Milliliter, unit of measure
μg/l	Micrograms per liter, unit of measure
pCi/l	Pico Curies per liter, unit of measure

Appendix D: References

Clescerl L., Greenberg A , and Eaton A (editors). Standard Methods for the Examination of Water and Wastewater, 20th edition. 1998. American Public Health Association and the Water Pollution Control Federation.

Ground Water Quality Plan. Available URL: http://www.deq.state.id.us/water/data_reports/ground_water/idaho_gw_quality_plan_final_entire.pdf.

Idaho Code §39-107. Board -- Composition -- Officers -- Compensation -- Powers --Subpoena -- Depositions -- Review – Rules. Available URL: http://www3.state.id.us/cgi-bin/newidst?sctid=390010007.K

Idaho Code §39-120(1)). Idaho Ground Water Quality Protection Act. Available URL:(http://www3.state.id.us/cgi-bin/newidst?sctid=390010002.K.

IDAPA 58.01.16. *Wastewater Rules.* Available URL: http://www2.state.id.us/adm/adminrules/rules/idapa58/0116.pdf.

IDAPA 58.01.11. *Ground Water Quality Rule*. Available URL: http://www2.state.id.us/adm/adminrules/rules/idapa58/0111.pdf.

IDAPA 58.01.23. Rules of Administrative Procedure before the Board of Environmental Quality. Available URL: http://www2.state.id.us/adm/adminrules/rules/idapa58/0123.pdf

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Appendix E: Monitoring Program Agreement

Project:

Location:

Project Purpose:

Project Duration:

Property Owner:

Operator:

Responsible Party:

The ground water quality monitoring program for ________________ recharge project is hereby approved by the Department of Environmental Quality (Department) pursuant to IDAPA 58.01.16.600, *Wastewater Rules, Land Application of Wastewater(s) or Recharge Waters*.

The number of sample sites, constituents, frequency, and reporting schedule are defined and described in the program. DEQ has determined the monitoring program to be protective of ground water quality for beneficial uses when adhered to as described. Failure to comply with the monitoring program is a violation of the Department's rules and the responsible party may be subject to enforcement action.

_________________________________ _______________________________
DEQ Regional Office Administrator Date

_________________________________ ___________________________
Responsible Party Date

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Appendix F: Example Monitoring Programs

Following are examples of monitoring programs for both a small and large area recharge project by land application of recharge water intended for infiltration from the surface to underlying aquifers. Technical staff from the Idaho Department of Water Resource (IDWR) and the Idaho Department of Environmental Quality (DEQ) have collaboratively refined the examples, which represent what is considered for approval of monitoring plans by DEQ under the authority of *Wastewater Rules* (IDAPA 58.01.16.600), DEQ is obligated, under the *Ground Water Quality Rule*, IDAPA 58.01.11, to protect present and future beneficial uses of the waters of the State.

As stated in the guidance, the **level of detail** or minimum requirements for monitoring will be determined by site specific hydrogeologic factors. The example of a small project (X1) identifies only one monitor well; however, one monitor well may not suffice for a different small project.

The example monitoring programs include additional information beyond what is described in the guidance. Supplemental information for the Milepost 31 monitoring program includes down-hole camera surveys and borehole geophysics. The monitoring program for the X1 site includes several graphs of water quality measurements. Supplemental information not addressed in the guidance is not a required element of a monitoring program.

Ground Water Quality Monitoring Program for the X1 Recharge Site

1.1 PROJECT DESCRIPTION

1.1.1 Location

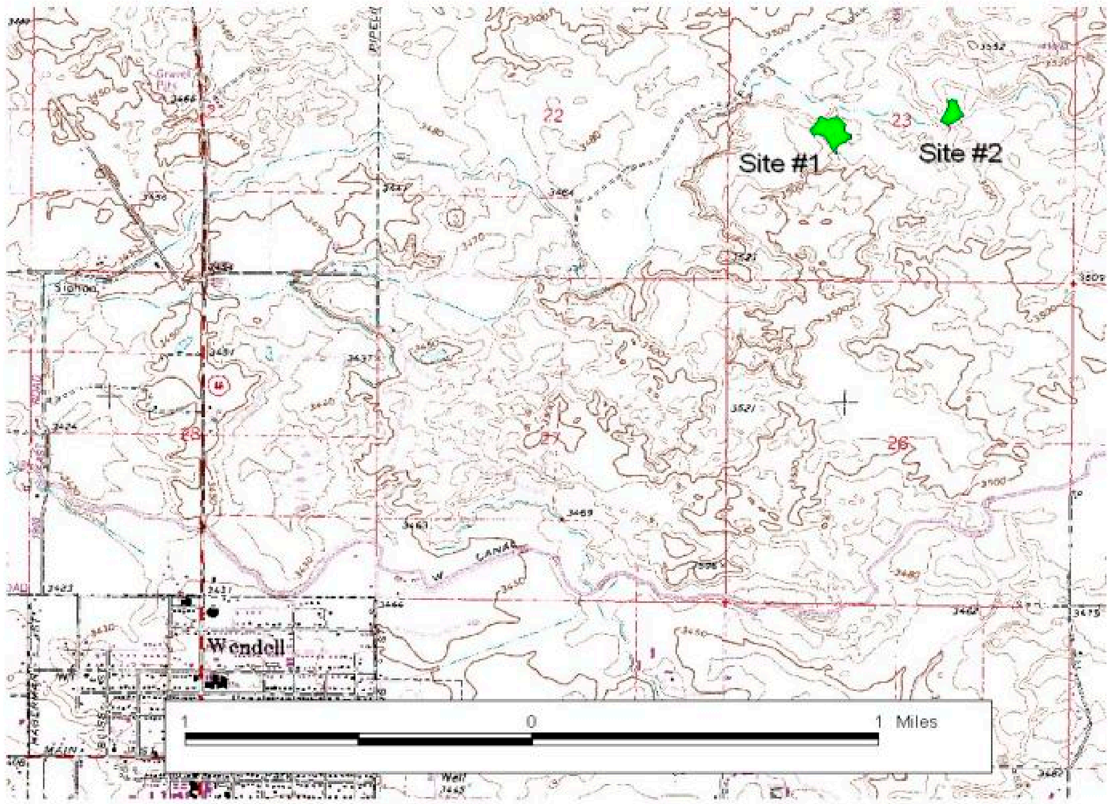

Figure 1: Location of recharge sites near the City of Wendell, Idaho

Two potential land applied recharge sites are located near the town of Wendell, Idaho in Section 23, Township 7 South, Range 15 East (Figure 1). Both sites are located near the X1 lateral canal operated by the North Side Canal Company (NSCC), approximately 2.5 miles north and east of the City of Wendell. The X1 is a small lateral that carries an estimated 25 to 30 cubic feet per second (cfs). Site 1 is the primary recharge basin of interest.

1.1.2 Physical Description

The recharge sites are small basins located adjacent to the X1 lateral. Site 1 is approximately 4.3 acres in size and Site 2 has an estimated size of approximately 1.8 acres. Water will be contained within the recharge basin as shown in Figure 2. If necessary, berms will be constructed on the south side of the basin to prevent spillage into an adjacent basin to the south. Use of the basin to the south of Site 1 will require fill be placed in and around exposed rock outcrops.

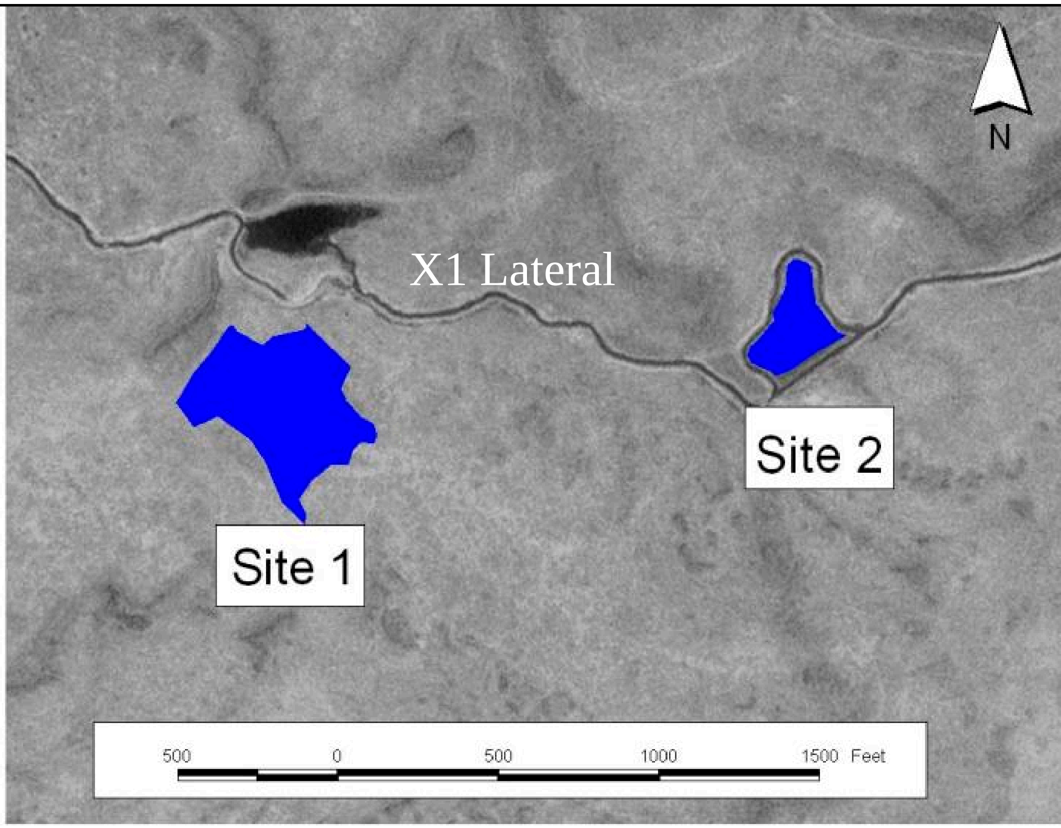

Figure 2: Vicinity map of recharge sites near the City of Wendell, Idaho

1.1.3 Land Ownership

The proposed recharge sites are situated on lands administered by the Idaho Department of Lands (IDL).

1.1.4 Project Purpose

This project is to provide mitigation for ground water right 37-7372. The water right is held by the Idaho Department of Lands.

1.1.5 Expected Outcome

The expected outcome of this project is the recharge of up to 1200 acre-feet/year with no detrimental impacts to ground water quality. Significant water purification is expected to occur as the recharge water percolates through the soils covering the recharge basin. The National Drinking Water Clearing House Fact Sheet on slow sand filtration indicates a filter bed 1 meter thick with an infiltration rate of 0.3 feet per hour (ft/hr) to 0.6 ft/hr is adequate for “virtually complete Giardia lambia cyst and Cryptosporidium oocyst removal.” Additionally, the removal capacity for coliforms is estimated to be 1-3 log units and 2-4 log units for enteric viruses. The infiltration rate at the recharge site has been measured at 0.15 ft/hr. Pathogen removal also should occur as the water percolates through the 200-foot thick unsaturated zone. Finally, microbiological contaminants will be further degraded as they travel through the aquifer.

1.1.6 Source of Recharge Water

The source water for recharge will come from the North Side Canal, which diverts water from the Snake River at Milner Dam. The operator will secure water for the purposes of recharge through the rental pool.

1.1.7 Volume of Recharge Water

Recharge will likely occur at the recharge sites throughout the irrigation season. Inflow rates will probably not exceed 4 cubic feet per second (cfs) with a total yearly recharge of up to 1200 acre-feet.

1.1.8 Project Duration

The project has an indefinite lifespan and will likely continue for over 20 years.

1.2 RECHARGE AREA CHARACTERIZATION

1.2.1.a Soils Information

Soils at the site are mapped as Ackelton-Jestrick-Rock outcrop complex, 2 to 12 percent slopes. A soils investigation was conducted at both Site 1 and Site 2 (Table 1). Two holes were augured at Site 1 and soils were textured as fine sandy loam. At Site 1, there was evidence of a duripan at 50 to 52 inches. The duripan is only evident when the soil is dry and will likely not restrict water flow when the soil profile is fully wetted. Several small-scale infiltration tests were conducting at each site using a four inch by two inch infiltration ring.

Table 4: Results of onsite soils investigation

Site #	1st Infiltration rate	2nd Infiltration rate	Soil depth	Texture Analysis
Site 1	12 in/hr	4 in/hr	50 inches	Fine sandy loam. Restrictive layer at 50 inches. May not be continuous over the basin.
Site1	6.7 in/hr	8 in/hr	50 inches	Surface Texture is fine sandy loam, no hole augured
Site 1	8 in/hr	No second test	50+ inches	Fine Sandy loam, restrictive layer present at 52 inches.
Site 2	14 in/hr	13 in/hr	36 inches	Fine sand – loamy fine sand. Basalt at 36 inches. No restrictive layer.
Site 2	15 in/hr	12.5 in/hr	34 inches	Fine sand – loamy fine sand. Basalt at 34 inches. No restrictive layer.

Infiltration rates (the rate at which water enters the soil) were calculated at 4 to 12 inches per hour (in/hr). Two holes were augured at Site 2 and soils were textured as fine sand to loamy fine sand. Depth to bedrock was 34 to 36 inches and there is one small area (approximately 25-35 sq feet) of exposed non-fractured basalt. Infiltration rates (unsaturated soil conditions) were calculated at 12 to 15 in/hr (Leah Juarros, Natural Resources Conservation Service [NRCS], personal communication). Permeability (the ability of a soil to transmit water in a saturated condition) is estimated at 0.6 – 6.0 in/hr (Johnson 2002).

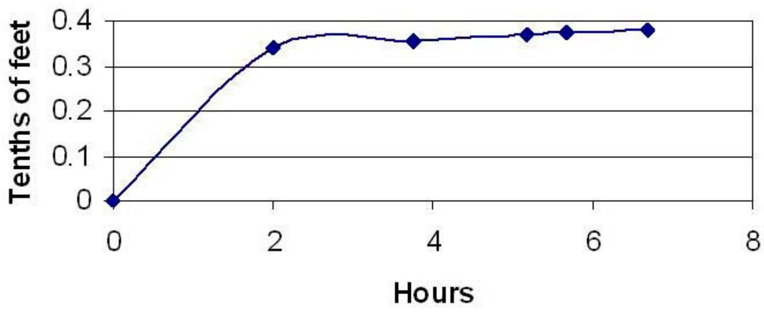

Figure 3: Rise of water in site 2 with an inflow of 0.5 cfs.

On September 15, 2003 a test diversion was conducted at Site 2. A staff gauge was placed in the basin and read periodically throughout the test. At approximately 9:30 a.m. 0.5 cfs was diverted from the X1 Lateral into the basin. Water was measured at a weir leading directly into the basin. Figure 3 shows the rise in water in basin during the recharge test. Water was shut off to the basin approximately 7.5 hours later. After termination of flow into the basin, water levels in the basin dropped approximately 0.15 feet/hour (1.8 inches/hour). On September 24 the basin was measured to determine the extent of the ponded area during the test. The ponded area was approximately 7380 square feet. If the permeability is 0.15 ft/hr and the total size of the basin is 1.8 acres, the actual capacity of the Site 2 recharge basin is estimated at 3.26 cfs. The permeability of 0.15 ft/hr (1.8 in/hr) is much lower than the infiltration rates measured during the soils investigation but is in agreement with permeability estimates from the soil survey that range from 0.6 – 6.0 in/hr (Johnson 2002). Using the permeability of 0.15 ft/hr, the recharge capacity of Site 1 is estimated at 7.8 cfs. The actual recharge capacity will be dependent upon the need to maintain a minimum freeboard at each site and a potential increase or decrease of permeability based upon soil plugging and changes in water depth (head) at each site.

1.2.1.b Surficial Geology

The surficial geology is described as Upper Pleistocene Snake Plain Lava Flows. Some rock outcrops occur within the recharge basin particularly along the north and eastside of the basin. On January 26, 2005, a site visit was made by staff from the IDL, Idaho Department of Environmental Quality (DEQ) and Idaho Department of Water Resources (IDWR). Visual inspection was made of all outcrops that occur within the basin. It was concluded that no large voids, fissures, or cracks were present that would potentially cause water quality problems. In fact, upon inspection the cracks were filled with soil, which acted as cementation within the outcrop, thus impeding the potential flow of water directly into the groundwater. Few animal burrows were located during a visual inspection. If Site 2 were used for recharge, water levels would be maintained at a level below basalt outcrops present in the basin.

There are no known faults within the recharge area.

1.2.2 Hydrogeologic and Surface Water Features

1.2.2a Vadose Zone Characterization

No data exist to characterize the vadose zone immediately beneath the X-1 recharge site, but it can be inferred from driller's reports of nearby wells. The nearest wells are a stock well located approximately 1000 feet south of the recharge site, and three household wells approximately 2400 feet southwest of the site. The rock beneath the entire area is predominantly massive basalt in layers ranging from a few feet to several tens of feet. Some of the flows are fractured but it is not clear from the reports how extensive that fracturing might be. Interflow zones most often consist of weathered rubble and cinders, but three of the wells penetrate multiple clay layers as much as 35 feet thick. The other well has no indication of sedimentary deposits at all which seems anomalous given its location between two wells with clay layers. The well drilling log of one domestic well describes approximately sixty feet of rock, sand and calcite. This may suggest the course of an ancient riverbed or shoreline, but no other well reports from the area indicate a similar lithologic unit.

1.2.2.b Aquifer System Characterization

The impact of recharge on the ground water level and flow direction near the recharge site was modeled to evaluate potential changes in ground water flow in response to managed recharge activities. The impact of managed recharge and canal leakage to the aquifer near the proposed recharge site was modeled using Wellhead Analytic Element Model (WhAEM), Version 3.1.1. Hydrologic conductivity zones and boundary conditions used in the model are similar to those used to develop the City of Wendell and City of Hagerman Source Water Assessment delineations (Wicherski, 2003).

Numerous simulations were run with different sets of aquifer parameters to calibrate the model to existing water level elevations. The aquifer parameters providing a reasonable match to existing water level elevations are contained in Table 2. The impact of canal leakage (in cubic feet per second per mile [cfs/mi])and the recharge rate to ground water levels and flow direction was determined for a variety of recharge and canal leakage scenarios. The results of the model simulations indicate canal leakage and recharge, at rates up to 30 cfs, do not change ground water flow directions. A recharge rate of 300 cfs changes the ground water flow direction in the immediate area of the recharge basin. The predicted responses of water level elevations 500 ft down-gradient from the recharge site to different recharge volumes and canal leakage rates are shown in Table 2.

Table 2 Model inputs and water level elevation changes

Scenario	Recharge rate	X-1 Canal leakage	W-Canal Leakage	K Value (ft/day)	Effective Porosity	Aquifer thickness	Water level rise
1	3 cfs	0	0	2,000	0.20	150 ft	0.55 ft
2	3 cfs	0.5 cfs/mi	1.0 cfs/mi	2,000	0.20	150 ft	0.95 ft
3	3 cfs	1.0 cfs/mi	1.0 cfs/mi	2,000	0.20	150 ft	1.16 ft
4	30 cfs	1.0 cfs/mi	1.0 cfs/mi	2,000	0.20	150 ft	5.20 ft
5	300 cfs	1.0 cfs/mi	1.0 cfs/mi	2,000	0.20	150 ft	45.58 ft

Particle tracking was conducted to evaluate the paths of recharge water at Site1 and Site 2 (contingency site). Approximately 3 cfs was added to Site 1 and 0.5 cfs was added to Site 2. The travel times indicate that once recharge water reached the water table, it would take about 30 days for water at Site 2 to travel in a southwesterly direction to Site 1. The pathlines also indicate much of the recharge at Site 2 would flow in a southwesterly direction below Site 1, allowing the monitoring well to identify any existing ground water impacts due to potential recharge at Site 2 (Figure 4).

The model indicates the water level in a well about 1.5 miles down-gradient from the recharge basin would rise about 1 foot in response to a recharge rate of 3 cfs and a canal leakage rate of 1 cfs per mile. These estimates of water level increase are likely high because recharge would not occur year round as simulated by the model.

Time of travel calculations indicate that once recharge water reaches the aquifer, it travels southwesterly at a rate of approximately ½ mile per month (88 ft/day). The average ground water velocity predicted by the City of Wendell Source Water Assessment delineation is 87 ft/day.

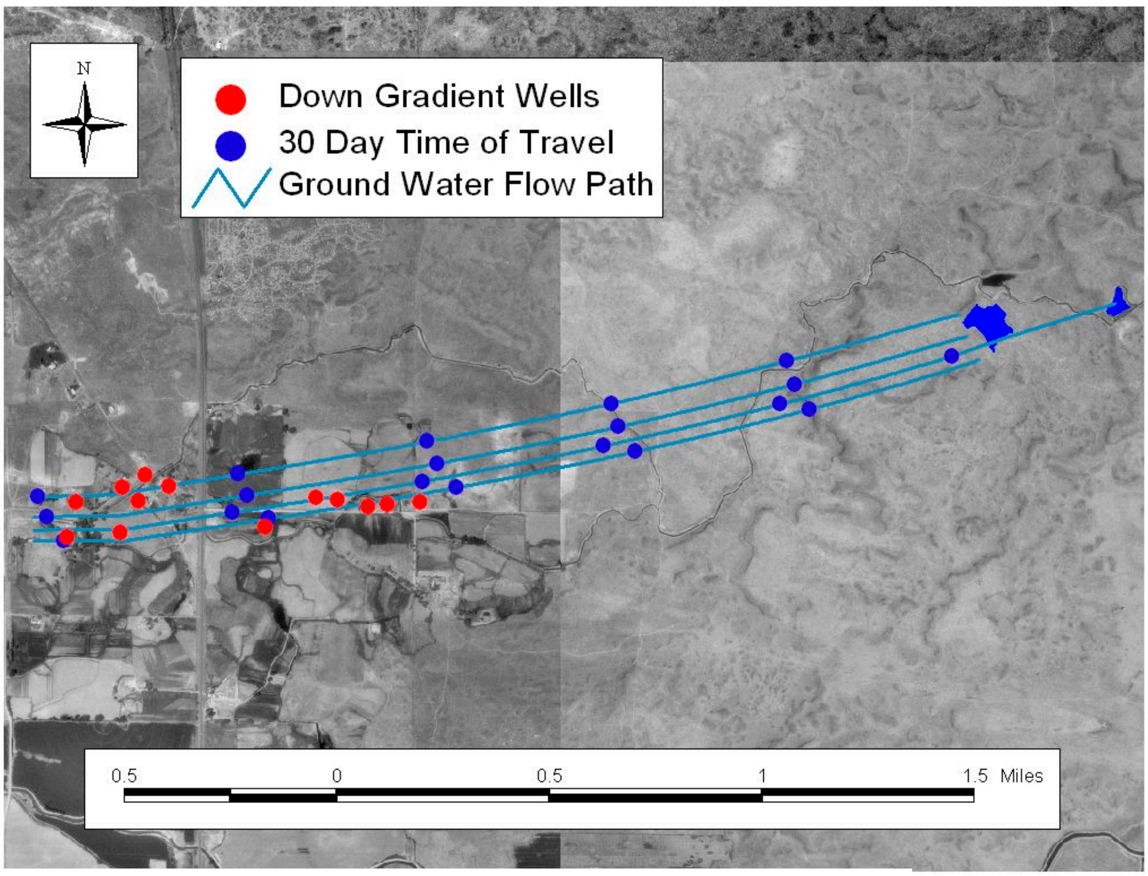

Figure 4: Travel path of ground water from the X1 Lateral site and down-gradient wells

Pathogen removal should occur as the water percolates through the 200 - foot thick unsaturated zone. Finally, microbiological contaminants will be further degraded as they travel through the aquifer.

Several domestic wells are located in or near the ground water flow path of the site. Five wells are located between 90 and 120 days travel time and eight wells are located between 120 and 180 days travel time down-gradient (Figure 4). Depth to water in those wells ranges from 145 to 189 feet below ground surface. All of these wells are also located in close proximity to canals or laterals. The X1 lateral crosses the flow path twice and runs parallel to the flow path approximately 1.5 miles down-gradient.

1.2.2.c Springs

There are no known springs that discharge in the vicinity of the recharge basins.

1.2.2.d Surface Water Features

Two irrigation canals are located near the recharge sites. The X1 Canal is located adjacent to the recharge sites and the W Canal is located approximately one mile to the south (Figure 5). Approximately 9.1 miles upstream of the recharge basins, the Main North Side Canal (U Canal) divides into the X Canal and the W Canal. The X1 canal diverts from the X Canal approximately 7.4 miles upstream of the recharge sites. A small pond on the X1 Canal lies north of Site 1. The pond was created by the installation of a check structure on the canal, which backs water up to form the pond.

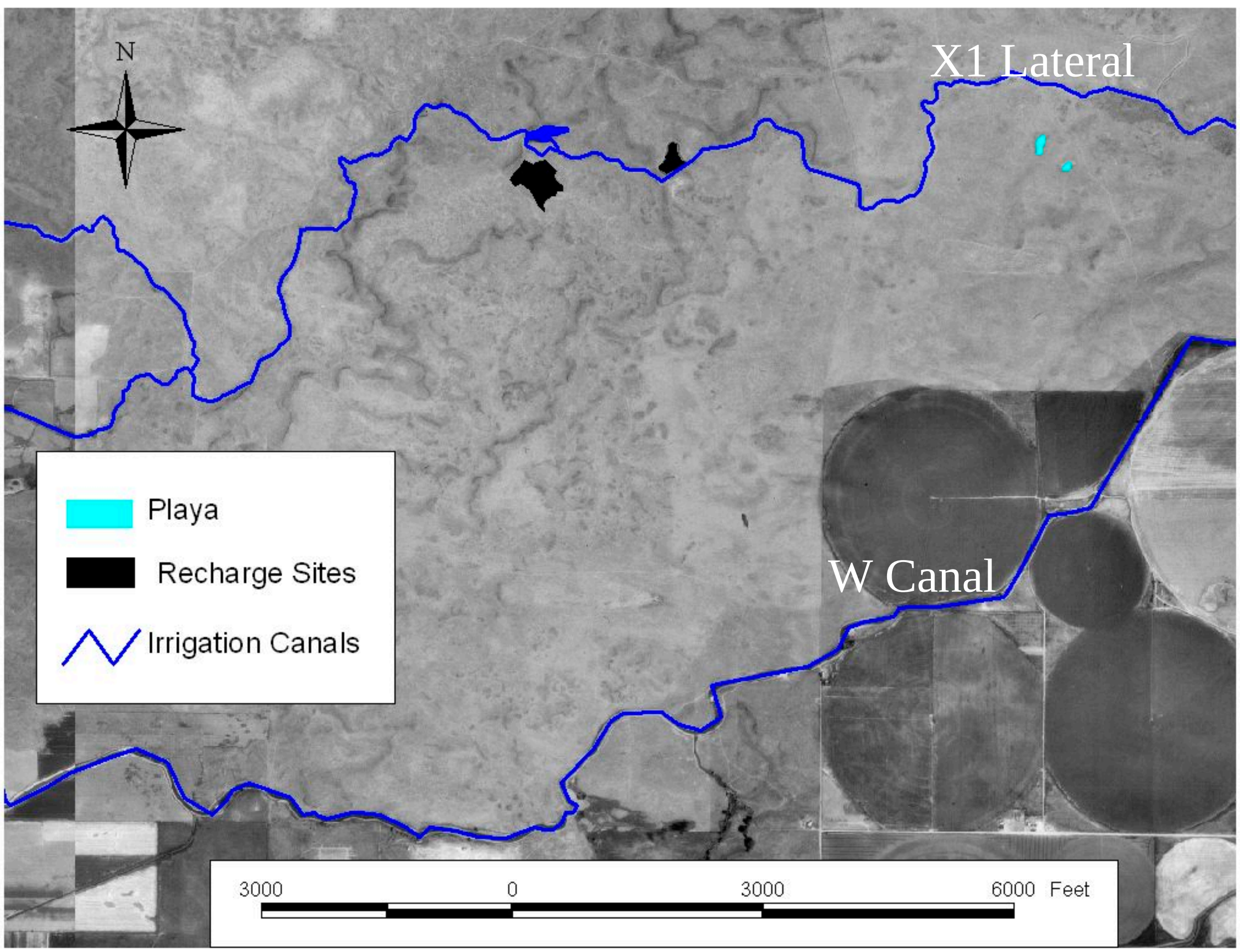

Figure 5: Surface water features at the X1 Lateral recharge site. Label recharge sites

Two small playas are located 4300 feet due east of the recharge sites. Recharge is not expected to have any impacts on those wetlands.

1.2.3 Potential Contaminant Sources and Land Use

1.2.3.a Potential Contaminant Sources

Several large dairies are situated adjacent to the North Side Canal upstream of the proposed project. The closest dairy is located on the south side of the X Canal approximately 8.5 miles upstream of the recharge basins (Figure 6). The X1 Canal diverts from the X Canal just downstream of the dairy. The canal lies upgradient of the dairy and no wastewater should enter the canal at this point.

The first 4.3 miles of the X1 Canal is located in or near irrigated cropland creating a potential for contamination from nutrients and pesticides (includes herbicides). Livestock grazing occurs on the lands adjacent to the X1 Canal for the remaining 3.1 miles to the recharge site and may represent a potential source for fecal bacteria (Figure 6).

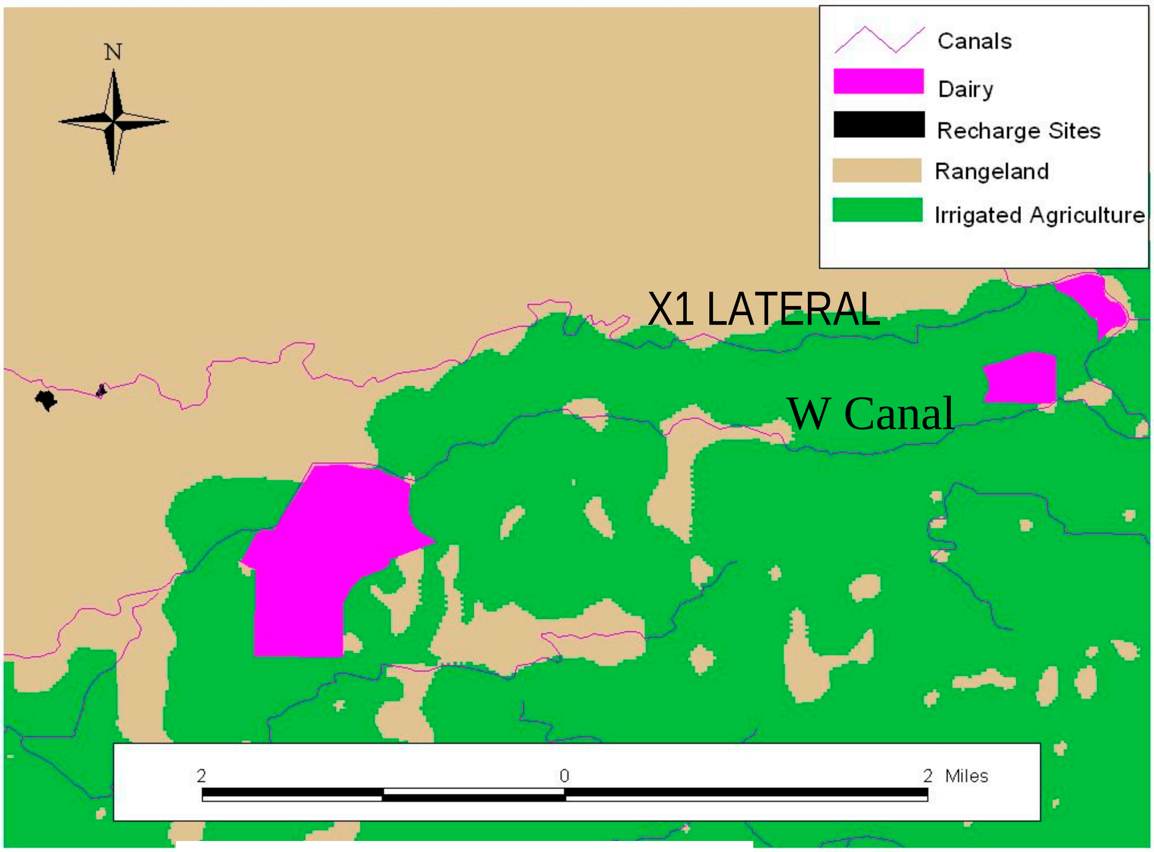

Figure 6: Land use upstream of the X1 recharge site.

The X1 Lateral does require periodic applications of herbicide primarily to control rooted macrophytes growth within the canal. Typically the North Side Canal Company (NSCC) treats the X1 approximately every three weeks. Two chemicals are used to treat the canal and include Magnacide H and Nautique. Magnacide H is a herbicide with the active ingredient of Acrolein (2-propenal) and is licensed for the control of submerged and floating weeds in irrigation canals. Nautique is an herbicide with the active ingredient copper carbonate and is also licensed for the control of nuisance plant growth in a variety of water bodies including irrigation canals. NSCC generally restricts the application of Magnacide H to two (2) applications per year and Nautique is used in the remaining applications and is applied at concentrations below drinking water standards (Larry Pennington, NSCC, personal communication). The application site is near the diversion of the X1 lateral from the X canal approximately 7.3 miles upstream of the proposed recharge site. For each application the NSCC records the following data:

- Application Time
- Air Temperature
- Water Temperature
- Length of Application
- Chemical Used
- Amount
- Water flow in the treated canal (cfs)
- Name of the Applicator

NSCC has collected data on the transport of Magnacide H through their canal system. In general, concentrations of Magnacide H at 10 miles downstream of the application site are less than 22 ppb. Further testing has shown that the canal is purged of the algaecide within 24 hours after the application of the herbicide. Nautique is applied to the canal at a rate of 1 parts per million (ppm), an allowable amount for the treatment of potable water.

1.2.3.b Land Use
The site was previously owned by the Bureau of Land Management and was recently transferred to the Idaho Department of Lands. The site has historically been used for livestock grazing and that use will continue for the foreseeable future.

1.2.3.c Vegetation
The site has a mixture of native and introduced rangeland plants including weedy herbaceous species. The inundation of the site during recharge activities is likely to eradicate the current plant communities. Appropriate action will be taken after recharge begins to control noxious weeds that may appear on the site.

1.2.4 Recharge Water Confinement Structures
If necessary, confining structures will be constructed at Site 1 to prevent water from spilling to a basin to the south. Water levels will be managed so as to prevent water from overflowing the basin.

1.3 POTENTIAL IMPACTS
The proposed project is not expected to harm the current quality of ground water in the vicinity of the recharge basins. Current leakage from canals and laterals does not appear to have had a negative impact on water quality. The proposed recharge sites appear to have adequate soil caps to remove most pathogenic organisms.

Noxious weeds are a potential problem within the recharge basins. Appropriate weed control measures will be taken to insure noxious weeds are controlled. Control measures may include but not be limited to:

- Mechanical Removal
- Grazing
- Herbicides

Only herbicides that are labeled for use in aquatic environments will be used and will be applied according to label instructions.

This monitoring plan is designed to demonstrate managed recharge does not degrade ground water quality. Surface water and ground water quality will be monitored before, during, and after recharge activities. Monitoring will focus primarily on those constituents that have been identified as potential pollutants of concern. Emphasis is placed on monitoring biological contaminants because these pose acute risks to human health.

1.4 WATER QUALITY MONITORING

1.4.1 Baseline Water Quality

Water quality in the Eastern Snake Plain Aquifer (ESPA) is generally quite good. Except for scattered incidences of elevated nitrates and organic compounds, the water is of suitable quality for domestic supplies without treatment. Because the historical record of water quality sampling is relatively short, it is difficult to determine how man's activities have impacted the aquifer over time.

Wood and Low (1988) estimated that about 5.6 billion cubic meters (m^3) of surface irrigation water has entered the aquifer as incidental recharge in 1980. Over one hundred years of irrigation seem to have had little impact on the concentrations of major ions in the ground water. They attribute this lack of impact on the fact that the ion chemistry of the surface water is similar to that of the ground water, and that even though the amount of water recharged seems large, it is still a small fraction of the total amount of water in the aquifer. Exacerbating the difficulty of identifying changes are the rapid flow rate in the aquifer, and natural variability in the water chemistry.

The basic chemistry does not vary a great deal in the ESPA. Wood and Low (1988) observed that generally the water becomes isotopically heavier with distance from the recharge areas as a result of evapotranspiration, and that carbon-13, calcium and bicarbonate increase with both distance and irrigation-induced carbonate dissolution. Mann and Low (1994) and Bartholomay, *et al* (1997) observed that tritium in the irrigated areas is also enriched as a result of recharge by surface water, while less-developed areas and those irrigated almost exclusively by ground water exhibit tritium values more closely regarded as background.

No water quality samples have been collected at the X-1 recharge site. Ground-water quality results from 8 Statewide Monitoring Program (SMP) wells (Figure 7) located nearest to the X-1 site, and surface water quality data collected by the U.S. Geological Survey (2003) at the stream gauge below Milner Dam on the Snake River and by the University of Idaho (2005) at points along the North Side Canal are summarized in this document. The surface water samples collected at the stream gauge are considered representative of water in the Milner pool since it is the only source of water in the Snake River at that point.

The different chemical constituents are compared to Primary and Secondary Constituent Standards established by the Idaho Department of Environmental Quality for ground water. Although these standards do not apply to the monitoring wells in a regulatory sense, they do provide a useful basis for comparison.

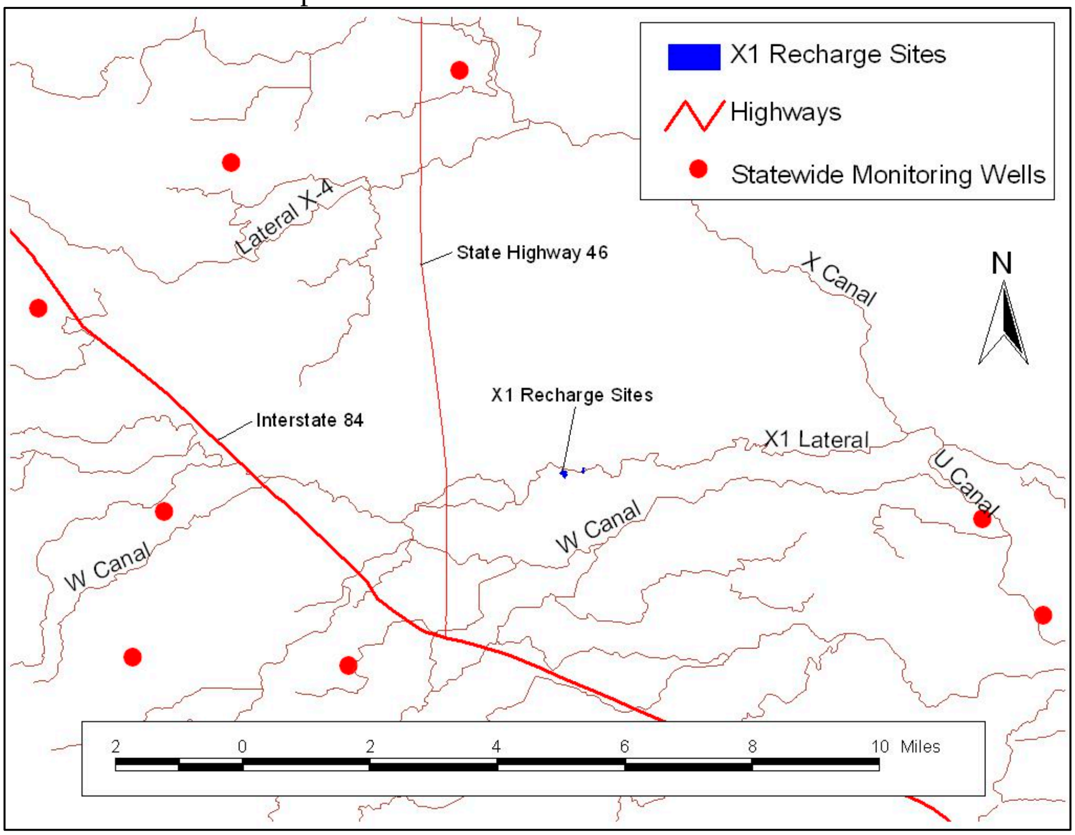

Figure 7: Statewide Monitoring well locations near the IDL Site, Gooding and Jerome Counties.

General Water Chemistry

Measurements of general water chemistry are summarized in Table 3. For the most part, measurements of constituents in the SMP wells and surface water are similar. Some surface water samples exceeded the recommended ground-water quality standard for pH of 8.5 (IDEQ, 2003) and generally the surface water samples had greater pH, dissolved oxygen and temperature, while alkalinity, hardness, and specific conductance tended to be higher in the ground water samples.

Table 3. Summary of general water chemistry near the IDL Site, Gooding County, Idaho.
[°C, degrees Celsius; $CaCO_3$, calcium carbonate; SCS, Secondary Constituent Standard; µs/cm, microsiemen per centimeter; mg/l, milligram per Liter; --, no value available]

General Water Chemistry	SMP Well Ranges	Surface Water Ranges	Ground-Water Standard	Standard Type
Alkalinity, mg/l as $CaCO_3$	128 - 163	123 - 198	--	--
Dissolved Oxygen, mg/l	5.7 - 6.4	8.0 - 14.6	--	--
Hardness, total, mg/l as $CaCO_3$	130 - 170	120 - 219	--	--
pH, standard units	7.3 - 8.2	7.3 - 9.0	6.5 - 8.5	SCS[1]
Specific Conductance, µs/cm at 25°C	328 - 416	314 - 575	--	--
Water Temperature, °C	14.4 - 15.9	4.0 - 20.5	--	--

[1]IDAPA 58 Title 01 Chapter 8, 2004

The University of Idaho sampled three sites on the North Side Canal during the 1993 irrigation season. The sites were identified as North Side Main Canal at the bridge north of City of Eden, North Side W Canal at the diversion from the U Canal north of the City of Jerome, and the X4 Lateral at the bridge on Shoestring Road north of the City of Wendell. The samples were analyzed for pH, specific conductivity, temperature, and dissolved oxygen. Most of the sample sets exhibited moderate increases in these parameters as the water travels downstream (Figures 8a to 8d).

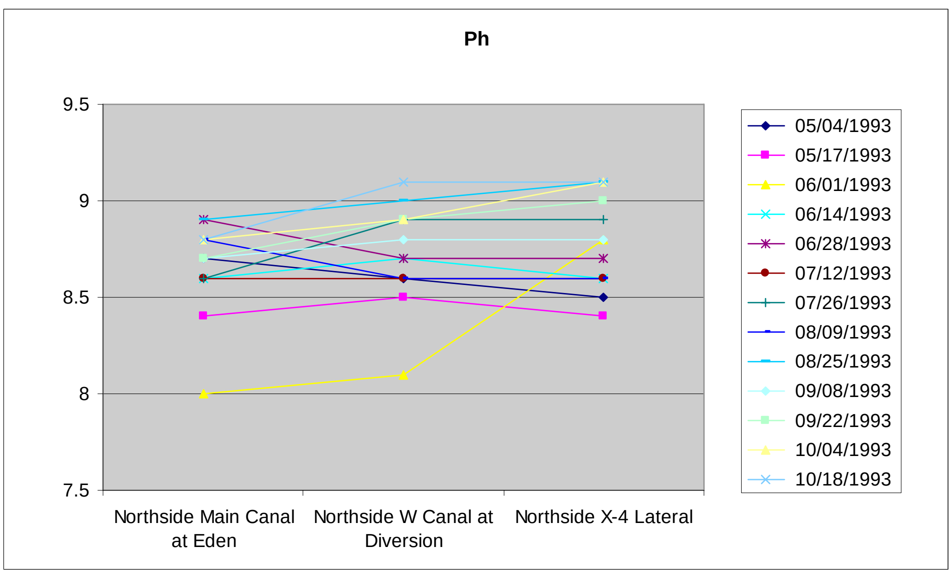

Figure 8a: Measurements of pH in the North Side Canal water in 1993.

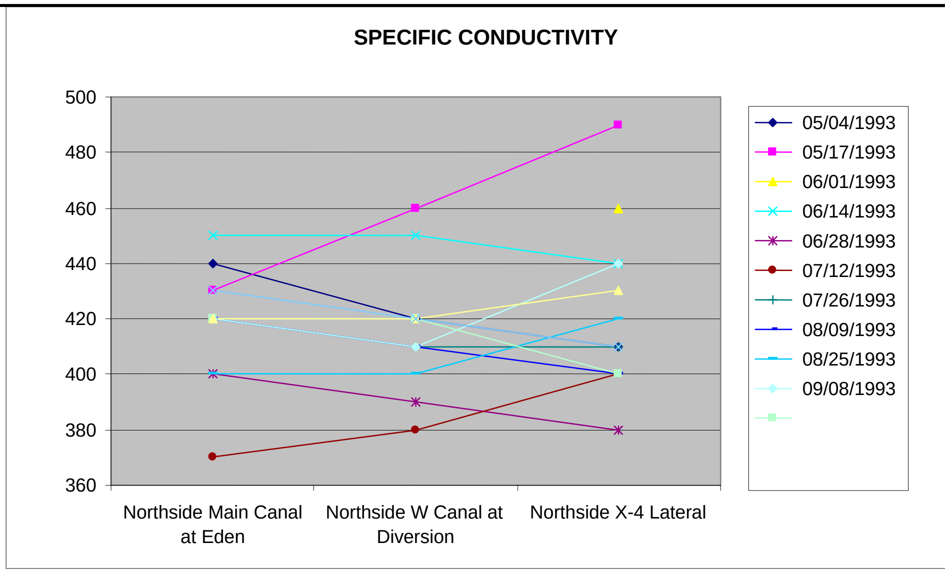

Figure 8b: Measurements of specific conductivity in the North Side Canal water in 1993.

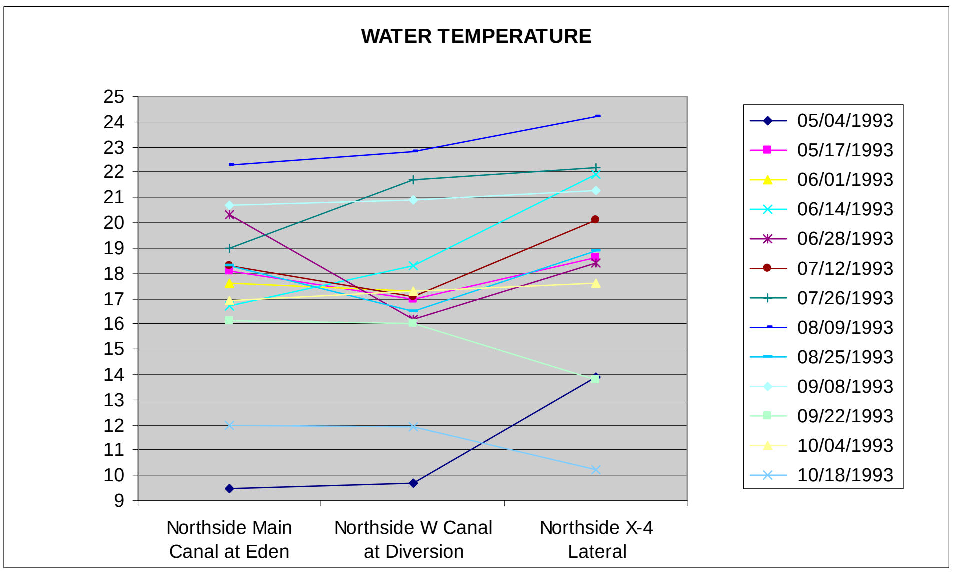

Figure 8c: Measurements of water temperature in the North Side Canal water in 1993.

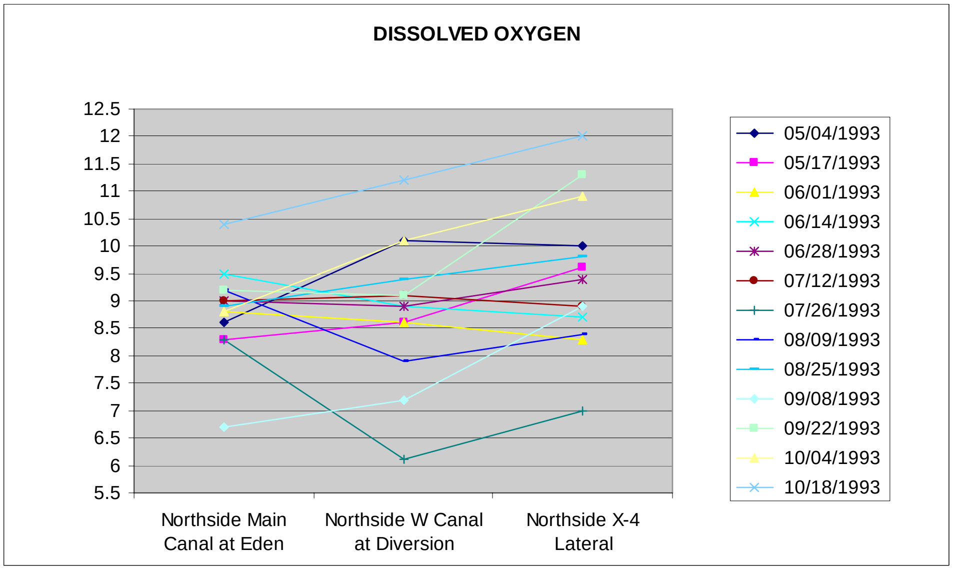

Figure 8d: Measurements of dissolved oxygen in the North Side Canal water in 1993.

Inorganic Constituents

The major inorganic constituents detected in samples for SMP sites near the IDL site include bicarbonate, calcium, chloride, magnesium, potassium, silica, sodium, and sulfate. Minor inorganic constituents detected include arsenic, barium, boron, chromium, fluoride, lithium, manganese, and selenium. Concentrations for constituents exceeding the reporting level in surface and ground water are summarized in Table 4 along with established constituent standards. None of the inorganic constituents exceeded established ground water quality standards.

The chemical composition of water from the SMP wells and the surface water sites is generally similar and there have been no analyses that have exceeded an existing ground water quality standard. The surface water analyses frequently show a wider range in constituent concentrations and often have a greater maximum concentration.

Table 4. Summary of inorganic constituents detected in water near the IDL site, Gooding County, Idaho
[E, estimated; mg/l, milligrams per liter; µg/l, micrograms per liter; PCS, Primary Constituent Standard; SCS, Secondary Constituent Standard; --, no value available]

Constituent	SMP Well Ranges	Surface Water Ranges	Ground-Water Standard	Standard Type[1]
Arsenic, µg/l as As	1.6 - 3.0	2.0 - 4.0	50	PCS
Bicarbonate, mg/l as HCO_3	156 - 200	120 - 220	--	--
Barium, µg/l as Ba	18.0 - 26.0	53.0 - 82.0	2000	PCS
Boron, µg/l as B	--	--	--	--
Cadmium, µg/l as Cd	<.04 - .23	<1	5	PCS
Calcium, mg/l as Ca	30 - 42	29 - 59	--	--
Chloride, mg/l as Cl	9.0 - 19.0	11.2 - 44.0	250	SCS
Chromium, µg/l as Cr	<1.0 - 4.0	<1 - 1	100	PCS
Copper, µg/l as Cu	<1.0 - 3.0	<1 - 7	1300	PCS
Iron, µg/l as Fe	<3 - 4	<3 - 10	300	SCS
Fluoride, mg/l as F	0.3 - 0.7	0.5 - 0.9	4	PCS
Lead, µg/l as Pb	<.08 - .22	0.28 - 4.00	15	PCS
Lithium, µg/l as Li	--	<1	--	--
Magnesium, mg/l as Mg	13.0 - 18.0	11.5 - 21.0	--	--
Manganese, µg/l as Mn	<1.0	<1.0 - 10.0	50	SCS
Potassium, mg/l as K	0.2 - 3.9	2.5 - 7.9	--	--
Selenium, µg/l as Se	0.4 - 0.8	--	50	PCS
Silica, mg/l as SiO_2	31.0 - 35.0	6.7 - 27.0	--	--
Silver, µg/l as Ag	--	<1	100	SCS
Sodium, mg/l as Na	13.0 - 22.0	11.5 - 21.0	--	--
Sulfate, mg/l as SO_4	21 - 36	24 - 64	250	SCS
Zinc, mg/l as Zn	<3 - 190	<3 - 9	5	SCS

[1]IDAPA 58 Title 01 Chapter 11, 1997

Nutrient and Bacteria Constituents

Dissolved nitrite plus nitrate are collectively referred to as nitrate and result from a wide variety of natural and anthropogenic processes, although the natural processes are almost always a minor factor in the overall nitrate levels. Nitrate levels in all analyses are below the maximum contaminant level (MCL) for drinking water of 10 mg/L, but often exhibit some impact from man's activities on the surface (Table 5). Orr and others (1991) estimated that natural concentrations of nitrate in the ESRP range from 0 to 1.4 mg/l. Samples collected from three sites on the North Side Canal during the 1993 irrigation season were analyzed for nitrate, total kjeldahl nitrogen and ammonia. Concentrations of each constituent were very low and generally decreased in the downstream direction (Figure 9a to 9c).

Table 5. Summary of nutrient constituents detected in water near the IDL site, Gooding County, Idaho. [col/100 ml, colony forming unit per 100 milliliters; PCS, Primary Constituent Standard; mg/l, milligram per liter; --, no value available]

Constituent	SMP Well Ranges	Surface Water Ranges	Ground-Water Standard	Standard Type
Nitrate + Nitrite, mg/l as N	ND - 2.4	<0.05 - 1.5	10	PCS[1]
Orthophosphorous, mg/l as P	--	<.01 - .22	--	--
Phosphorous, mg/l as P	<0.02 - 0.04	0.03	--	--
Fecal Coliform Bacteria, col/100 ml	<1	<1 - 66	--	--

[1]IDAPA 58 Title 01 Chapter 11, 1997

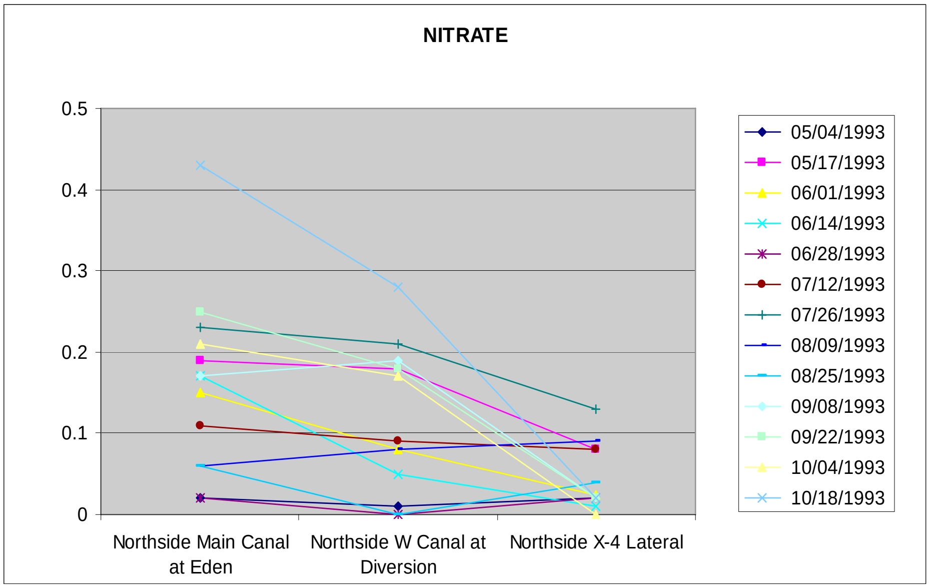

Figure 9a: Measurements of nitrate in the North Side Canal water in 1993.

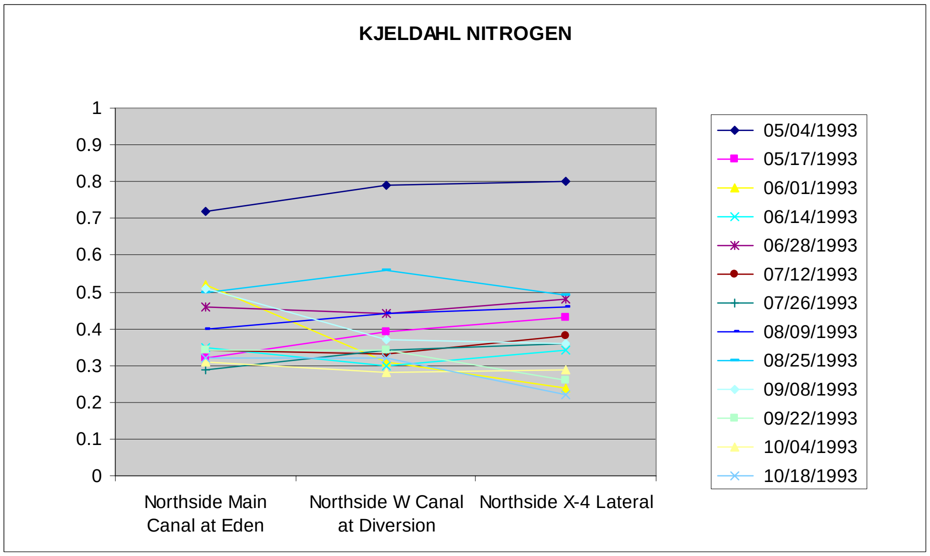

Figure 9b: Measurements of kjeldahl nitrogen in the North Side Canal in 1993.

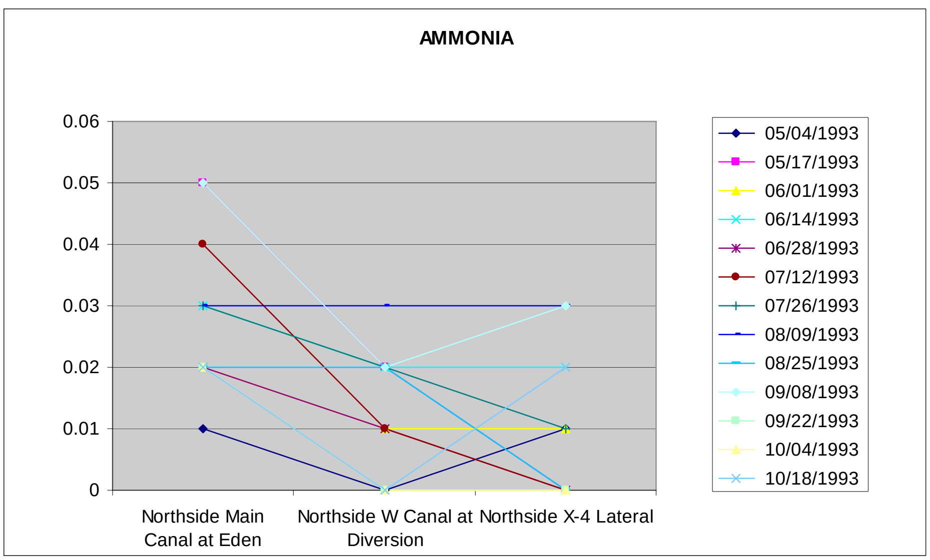

Figure 9c: Measurements of ammonia in the North Side Canal water in 1993

Phosphorus is an important nutrient in plants and its occurrence in ground water can again be attributed to a wide variety of natural processes and human activities. High concentrations can promote eutrophication of water bodies. Concentrations in all analyses are low, but are more likely to be related to man's activities than natural dissolution of the aquifer matrix (Table 5). Concentrations of total phosphorous and orthophosphorous in samples collected from the North Side canal is generally decreased as water progressed downstream (Figure 9d and 9e).

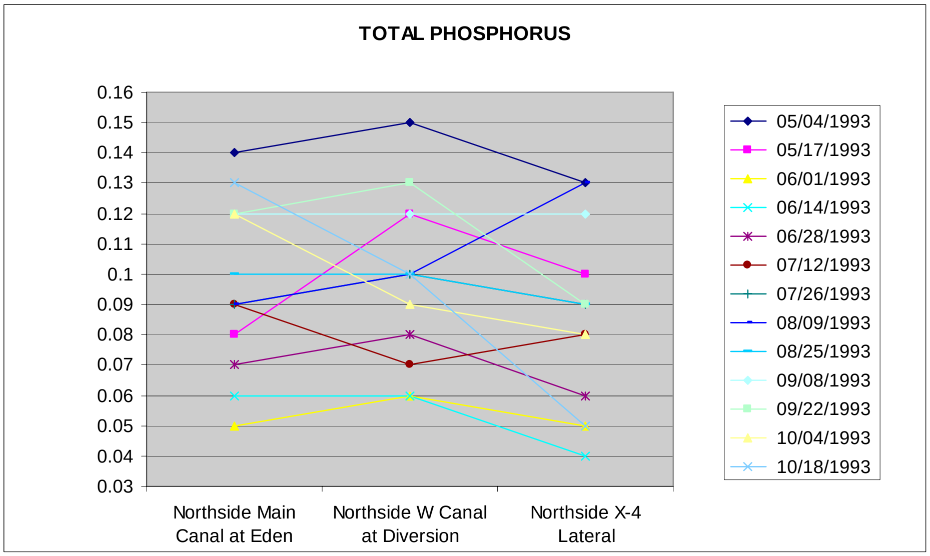

Figure 9d: Measurements of total phosphorus in the North Side Canal water in 1993.

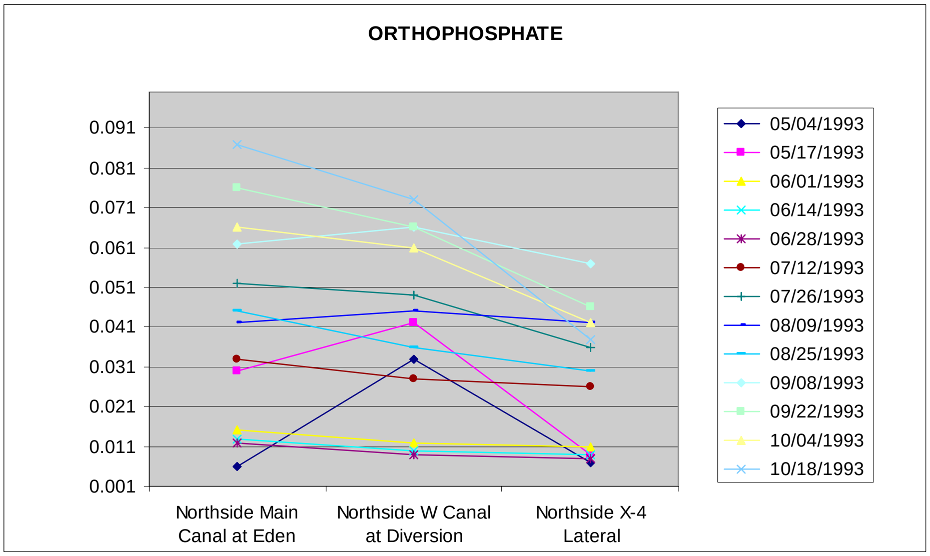

Figure 9e: Measurements of orthophosphate in the North Side Canal water in 1993.

Coliform bacteria are an indicator of possible pollution by intestinal bacterial or viruses, while fecal coliform bacteria almost always indicate the presence of waste from warm-blooded organisms. The surface water samples frequently contained significant numbers of fecal coliform bacteria colonies up to 66 colonies per 100 milliliters (Table 5), and were not observed in ground-water samples from SMP sites.

The background level of Cryptosporidium and Giardia in ground water at the site is unknown.

Radioactivity and Tritium

Gross alpha and gross beta radioactivity comes from a wide variety of naturally occurring and man-made radionuclides. They are reported as if the radioactivity were all given off by one radionuclide, in this case gross alpha as thorium-230 and gross beta as cesium-137. This is for reporting convenience only and does not imply that the radioactivity can be attributed to these specific isotopes. The results are reported as a concentration plus or minus an uncertainty of two standard deviations. For these data, there is a 95-percent probability that the true concentration is in the range of the reported concentration plus or minus the uncertainty. Additionally, if the reported concentration is less than the uncertainty, it is considered to be below the reporting level.

Gross alpha and gross beta particle radioactivity was measured in samples from the SMP wells. Tritium data are not available for the SMP wells so data from selected USGS monitoring wells located upgradient from the recharge site in Jerome County are reported along with one surface water sample (Table 6). None of the samples exceeded the respective ground water quality standards.

Table 6. Summary of radioactivity and tritium detected in water near the IDL site, Gooding County, Idaho.
[pCi/l, picocuries per liter; PCS, Primary Constituent Standard; --, no value available]

Constituent	SMP Well Ranges[1]	Surface Water Ranges	Ground-Water Standard	Standard Type
Gross Alpha Radioactivity, pCi/l as Thorium-230	1.7±2.6 - 3.8±2.8	--	15	PCS[2]
Gross Beta Radioactivity, pCi/l as Cesium-137	2.8±1.3 - 6.1±1.4	--	[3]	PCS[2]
Tritium, pCi/l	1±1 - 110±7	43±3	20,000	PCS[2]

[1]Tritium data from U.S. Geological Survey monitoring wells in Jerome County, ID
[2]IDAPA 58 Title 01 Chapter 11, 1997[3], 4 millirems/year effective dose equivalent (Cesium-137 dose equivalent equals 120 pCi/l)

Volatile Organic Compounds and Pesticides

Volatile organic compounds (VOCs) and pesticides are not commonly found in ground water in the Eastern Snake River Plain aquifer. In samples collected from the SMP wells near the IDL site, no VOCs were detected. None of the surface water samples were analyzed for VOCs.

Table 7 lists the VOCs that were not detected in any samples. Table 8 lists the pesticides that were not detected in any samples.

Table 7. Volatile organic compounds not detected in water near the IDL site, Gooding County, Idaho.

Volatile Organic Compounds not Detected			
1,1-Dichloroethane	1,2,4-Trichlorobenzene	Carbon Tetrachloride	Isodurene
1,1-Dichloroethylene	1,2,4-Trimethylbenzene	Chlorodibromomethane	Isopropylbenzene
1,1-Dichloropropene	1,3-Dichloropropane	Chloroethane	p-Isopropyltoluene
1,1,1-Trichloroethane	e,z-1,3-Dichloropropene	Chloroform	Methyl Tert Butyl Ether (MTBE)
1,1,1,2-Tetrachloroethane	1,3,5-Trimethylbenzene	Chloromethane	Monochlorobenzene
1,1,2-Trichloroethane	2,2-Dichloropropane	o-Chlorotoluene	Naphthalene
1,1,2,2-Tetrachloroethane	Benzene	p-Chlorotoluene	n-Propylbenzene
1,2-Dibromoethane (EDB)	Bromobenzene	Dibromomethane	Styrene
1,2-Dichloroethane	Bromochloromethane	m-Dichlorobenzene	Tetrachloroethylene
cis-1,2-Dichloroethylene	Bromodichloromethane	o-Dichlorobenzene	Toluene
trans-1,2-Dichloroethylene	Bromoform	p-Dichlorobenzene	Trichloroethylene
1,2-Dichloropropane	Bromomethane	Dichlorodifluoromethane	Trichlorofluoromethane
1,2-Di-3-chloropropane (DBCP)	n-Butylbenzene	Dichloromethane	Vinyl Chloride
1,2,3-Trichlorobenzene	sec-Butylbenzene	Ethylbenzene	Xylenes
1,2,3-Trichloropropane	tert-Butylbenzene	Hexachlorobutadiene	

Table 8. Pesticides and degradation products not detected in water near the IDL site, Gooding County, Idaho.

Pesticides Not Detected			
2,4-D	Chloramben	Disulfoton	Pentachlorophenol
2,4-DB	Chlordane-alpha	Endosulfan I	cis-Permethrin
2,4,5-T	Chlordane-gamma	Endosulfan II	trans-Permethrin
2,4,5-TP (Silvex)	Chlorneb	Endosulfan sulfate	Picloram
4,4-DDD	Chlorobenzilate	Endrin	Prometryn
4,4-DDE	Chlorothalonil	Endrin aldehyde	Pronamide
4,4-DDT	Chlorpropham	Heptachlor	Propachlor
Acifluorfen	Chlorpyrifos	Heptachlor epoxide	Propazine
Alachlor	Cyanazine	Hexachlorobenzene	Stirofos
Aldrin	Dacthal	Lindane	Terbufos
Bentazon	Dalapon	Methoxychlor	Tetralin
BHC-alpha	Diazinon	Metribuzin	Triademefon
BHC-beta	Dicamba	Mevinphos	Tricyclazole
BHC-delta	Dichloroprop	MGK 264	Trifluralin
Bromacil	Dieldrin	Molinate	Vernolate
Butachlor	Dinoseb	trans-Nonochlor	
Butylate	Diphenamid	Norflurazon	

A sample collected from one SMP well near the IDL site contained the pesticide acetochlor at 0.07 micrograms per liter (µg/l). One surface water sample collected at Milner Reservoir detected atrazine at 0.006 µg/l , EPTC at 0.10 µg/l and ethoprop at 0.004 µg/l. A second sample detected atrazine at 0.004 µg/l and EPTC at 0.041 µg/l. In the same sample, carbofuran, metolochlor, and simazine were tentatively detected at concentrations below reporting levels.

Baseline Ground Water Quality Summary

Ground water quality in SMP wells near the IDL site is quite good. No data are available at the site, but the quality is expected to be similar to other wells in the area.

General water chemistry falls within normal ranges for samples from the ESPA. Samples from ground water and surface water sources exhibit similar characteristics. Samples collected from locations on the North Side Canal show seasonal and temporal variations.

Inorganic constituents demonstrate the influence of surface water irrigation on ground-water quality. None of the constituents exceeded established water quality standards in any of the samples reported.

Nutrient concentrations in both ground and surface water samples were very low and did not exceed water quality standards. Concentrations collected from the North Side Canal displayed seasonal variations and generally decreased as water traveled downstream. Coliform bacteria was not observed in ground water samples, but were often detected in samples from the Snake River below Milner Dam.

Gross alpha and gross beta radioactivity fell within the normal range for samples from the ESPA. Concentrations of tritium reflect the surface water influence on ground water.

Volatile organic constituents were not detected in any surface or ground water samples. Acetochlor was detected in one SMP sample and atrazine, EPTC, and ethoprop were detected in two samples from the Snake River below Milner Dam.

1.4.2 Water Quality Monitoring Locations

One monitoring well is proposed to monitor ground water quality at the recharge site. The monitoring well should provide information on ground water quality down-gradient from the recharge basin and would allow ground water quality concerns to be identified..

The proposed location of the monitoring well is based upon the results of the WHAEM model. The direction of ground water flow was determined based upon recharge occurring at Site 1 and Site 2 and canal leakage. Figure 10 shows that proposed location of the monitoring well. The site is located approximately 500 feet downgradient of Site 1 and is 300 feet due south of a point located at N42.803512, W114.669752, North American 1983 datum. The location of this well should intercept ground flow occurring as a result of recharge at Site 1 and Site 2.

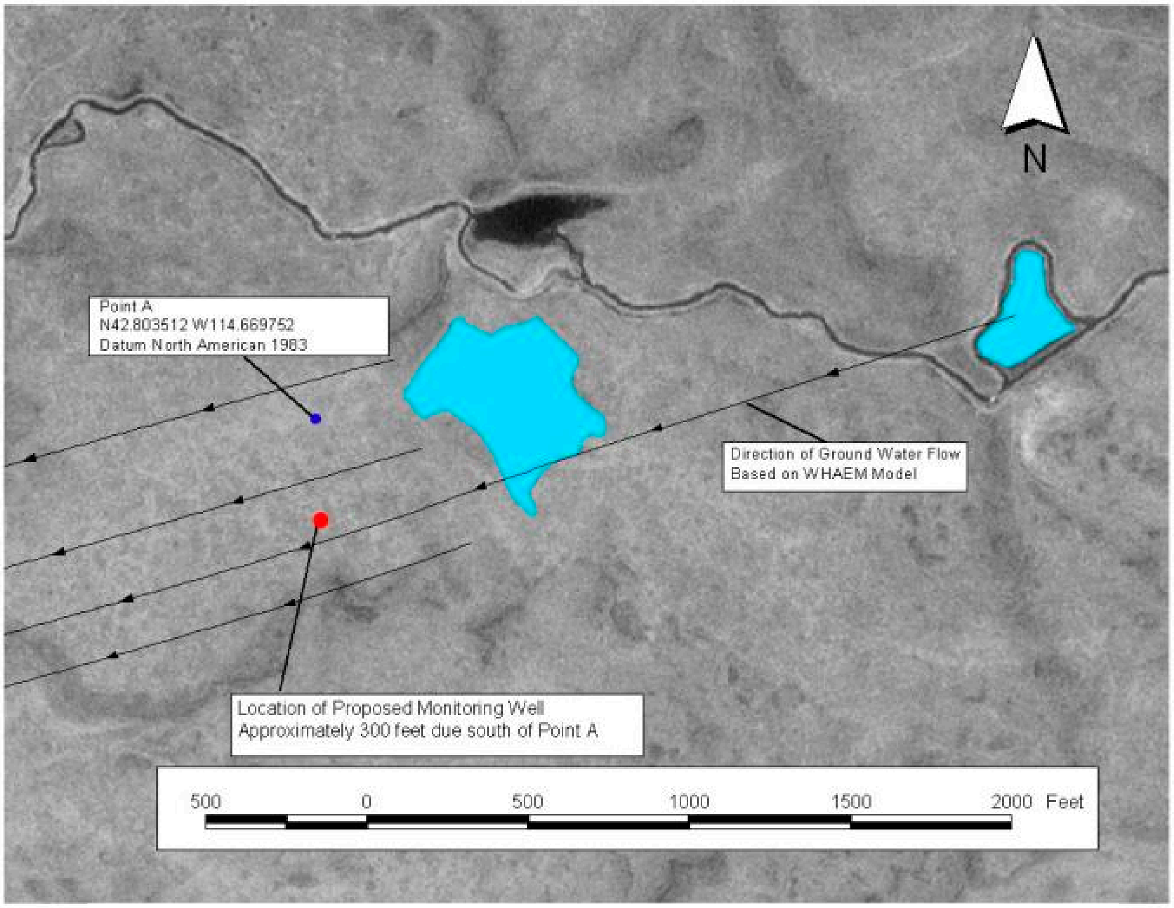

Figure 10: Location of proposed monitoring well for the X1 recharge site.

1.4.3 Water Quality Monitoring Parameters and Frequency

Attachment 1 provides the monitoring parameters, analysis method Idaho Ground Water Quality Standard, alert level and sampling frequency of surface and ground water monitoring for the X1 recharge site.

The operator shall keep appropriate records to determine the volume of water diverted into the recharge site. Those records should contain the amount of water diverted and any changes by date of the amount of water diverted into the recharge site, the yearly commencement date of recharge activities, the yearly termination date of recharge activities and the total volume (in acre-feet) of water diverted into the recharge site.

Surface water quality samples will be collected near the point of diversion into the recharge basin. A plastic disposable device will be used to collect a grab sample at an interval of zero (0) to two (2) feet from the surface of the canal. Sample bottles will be directly filled and appropriate preservatives will be added.

Ground water samples will be taken from the monitoring well via bailing techniques.

Samples will be collected in a manner consistent with the Statewide Ambient Ground Water Quality Monitoring Program (Statewide Program). Samples will be submitted to the Idaho State

Bureau of Laboratories in Boise for analysis. Samples will be shipped according to standard operating procedures (SOP) with appropriate sample labels. If samples are collected for VOC analysis, a trip blank will be included with the sample for testing after shipment. Statewide Program SOPs are available from IDWR.

1.5 MANAGEMENT PRACTICES

1.5.1 Reporting Schedule

The laboratory will notify the sampling entity as soon as possible if bacteria or pathogens are present in the ground water samples. If any constituent exceeds the alert values in the section entitled Alert Levels, the operator will suspend recharge and notify the IDWR and the DEQ Regional Office immediately and a confirmatory sample will be collected within three (3) days receipt of the laboratory notification. IDWR and DEQ will consult on contingency actions to include but not be limited to: immediate suspension of all recharge activities, request additional confirmatory sampling, or require additional analysis to determine the probable source of contamination. If IDWR and DEQ determine that recharge activities may continue, the operator may be required to do additional source water monitoring. Any sampling that exceeds alert levels will be noted in an annual monitoring report.

The operator of the recharge site will develop an annual report to be forwarded to the Idaho Department of Water Resources and the Idaho Department of Environmental Quality. The report will include the following elements in a format suitable to IDWR:

1. Records of the examination of the recharge basin for deleterious material prior to the commencement of recharge activities.
2. Records of the date recharge activities commence, the rate of diversion (in cfs) and the volume of water (in ac-ft) diverted into the recharge basin.
3. Date and time of each sample collected.
4. Data sheets containing the analysis of each sample.

1.5.2 Contingency Plan

NSCC will close the headgate to the recharge site during the application of either Magnacide H or Nautique. DEQ will be notified prior to application by the operator. The headgate will remain closed for approximately 24 hours after any chemical application. Nautique will continue to be applied at or below drinking water quality standards. This arrangement is not new for NSCC as they have a number of organic farmers whose headgates are also closed during the application of herbicides.

In the event of other critical events such as a pesticide or petroleum spill, the headgate to the recharge site will be closed and remain closed until authorization is provided by DEQ that recharge operations may resume.

Prior to the start of any recharge activity the operator will inspect the recharge basin for any possible contamination of the recharge site by hazardous materials. A record of this inspection will be kept and shall be a part of the monitoring report.

1.5.3 Recharge Water Treatment

The recharge water will receive no treatment prior to recharge.

General Conditions

This plan will be adhered to during the operation of the managed recharge site. The operator of the site will carry all out monitoring activities and will follow reporting procedures required in the plan. Changes to monitoring constituents and monitoring frequency can be made if upon consultation with IDWR and IDEQ those constituents are not considered to be a threat to ground water quality. Changes to the monitoring plan can be recommended based upon the results of previous monitoring.

Any changes to this plan will require sixty (60) days written notice prior to the commencement of recharge activities by any signatory to this plan and must be agreed to by the other signatories to this plan.

Monitoring reports will be filed with IDWR and IDEQ on a yearly basis except in those instances where immediate notification of IDWR and IDEQ is required. Monitoring reports will be mailed to IDWR at:

Managed Recharge Coordinator
Idaho Department of Water Resources
PO Box 83720
Boise, ID 83720-0098
1-208-287-4840

and with DEQ at:

Managed Recharge Coordinator
Idaho Department of Environmental Quality
Twin Falls Regional Office
601 Pole Line Rd., Suite 2
Twin Falls, ID 83301
1-208-736-2190, or
1-208-539-9757

References:

Barnes, K. K., Kolpin, D. W., Meyer, M. T, Thurman, E. T., Furlong, E. T., Zaugg, S. D., and Barber, L. B., 2002, Water-quality data for pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000: U. S. Geological Survey Open-File Report 02-94, available on the World Wide Web at URL http://toxics.usgs.gov/pubs/OFR-02-94/index.html.

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Attachment 1
Monitoring Parameters

Ground Water Sampling				
Constituent	Analysis Method	Idaho Ground Water Quality Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)	Sampling Frequency
Field Parameters				
Specific Conductance	Probe	none	na	Monthly*
pH	Probe	none	na	Monthly*
Temperature	Probe	none	na	Monthly*
Dissolved Oxygen	Probe	none	na	Monthly*
Depth to Water	Probe	none	na	Monthly*
Coliform Bacteria				
Total Coliform	SM 9221B	>0	Detection	Monthly*
Total Fecal Coliform	SM 9222B	>0	Detection	Monthly*
E.coli	SM 9223B	>0	Detection	Monthly*
CLPP		none	na	Upon Request*
Giardia and Cryptosporidium	EPA 1623	>0	Detection	Upon Request*
Common Ions				
Calcium	EPA 200.7	none	na	Bimonthly**
Sodium	EPA 200.7	none	na	Bimonthly**
Magnesium	EPA 200.7	none	na	Bimonthly**
Potassium	EPA 200.7	none	na	Bimonthly**
Chloride	EPA 300.0	250	125	Bimonthly**
Bicarbonate	EPA 310.1	none	na	Bimonthly**
Sulfate	EPA 300.0	250	125	Bimonthly**
Nutrients				Bimonthly**
Nitrate	EPA 353.2	10	5	Bimonthly**
Nitrite	EPA 353.2	1	1	Bimonthly**
Total Phosphorus	EPA 365.1	none	na	Bimonthly**
Pesticides				Bimonthly**
2,4-D	immunoassay	0.7	Detection	Bimonthly**
Alachlor	immunoassay	0.02	Detection	Bimonthly**
Aldicarb	immunoassay	none	Detection	Bimonthly**
Atrazine	immunoassay	0.03	Detection	Bimonthly**
Carbofuran	immunoassay	0.4	Detection	Bimonthly**
Metolachlor	immunoassay	none	Detection	Bimonthly**
Magnacide (acrolein)	*immunoassay*	*none*	*Detection*	*After Application*

(continued)

Ground Water Sampling (cont)				
Constituent	Analysis Method	Idaho Ground Water Quality Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)	Sampling Frequency
VOCs				
Benzene	EPA 524.2	0.005	Detection	Quarterly***
Bromobenzene	EPA 524.2	none	Detection	Quarterly***
Bromochloromethane	EPA 524.2	none	Detection	Quarterly***
Bromoform	EPA 524.2	none	Detection	Quarterly***
Bromomethane	EPA 524.2	none	Detection	Quarterly***
Butylbenzene, n-	EPA 524.2	none	Detection	Quarterly***
Butylbenzene, -sec	EPA 524.2	none	Detection	Quarterly***
Carbon Tetrachloride	EPA 524.2	0.005	Detection	Quarterly***
Chlorobenzene	EPA 524.2	0.1	Detection	Quarterly***
Chloroethane	EPA 524.2	none	Detection	Quarterly***
Chloroform	EPA 524.2	none	Detection	Quarterly***
Chloromethane	EPA 524.2	none	Detection	Quarterly***
Chlorotoluene,-o	EPA 524.2	none	Detection	Quarterly***
Chlorotoluene-p	EPA 524.2	none	Detection	Quarterly***
Dibromochloromethane	EPA 524.2	none	Detection	Quarterly***
Dibromochloropropane (DBCP)	EPA 524.2	0.0002	Detection	Quarterly***
Dibromoethane,1,2- (EDB)	EPA 524.2	0.0005	Detection	Quarterly***
Dibromomethane	EPA 524.2	none	Detection	Quarterly***
Dichlorobenzene,1,2-	EPA 524.2	0.6	Detection	Quarterly***
Dichlorobenzene,1,3-	EPA 524.2	none	Detection	Quarterly***
Dichlorobenzene,1,4-	EPA 524.2	0.075	Detection	Quarterly***
Dichlorobromomethane	EPA 524.2	none	Detection	Quarterly***
Dichlorodifluoromethane	EPA 524.2	none	Detection	Quarterly***
Dichloroethane,1,1-	EPA 524.2	none	Detection	Quarterly***
Dichloroethane,1,2-	EPA 524.2	0.005	Detection	Quarterly***
Dichloroethene,1,1-	EPA 524.2	0.007	Detection	Quarterly***
Dichloroethene,1,2,cis-	EPA 524.2	0.07	Detection	Quarterly***
Dichloroethene,1,2,trans-	EPA 524.2	0.1	Detection	Quarterly***
Dichloropropane,1,2-	EPA 524.2	0.005	Detection	Quarterly***
Dichloropropane,1,3-	EPA 524.2	none	Detection	Quarterly***
Dichloropropane,2,2-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,1,1-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,1,3 cis-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,1,3 trans-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,e,z-1,3-	EPA 524.2	none	Detection	Quarterly***
Ethylbenzene	EPA 524.2	0.7	Detection	Quarterly***
Hexachlorobutadiene	EPA 524.2	none	Detection	Quarterly***
Isodurene	EPA 524.2	none	Detection	Quarterly***
Isopropylbenzene	*EPA 524.2*	*none*	*Detection*	*Quarterly****

Ground Wwater Sampling (cont)				
Constituent	Analysis Method	Idaho Ground Water Quality Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)	Sampling Frequency
Methyl tertiary butyl ether (MTBE)	EPA 524.2	none	Detection	Quarterly***
Methylene chloride	EPA 524.2	none	Detection	Quarterly***
Naphthalene	EPA 524.2	none	Detection	Quarterly***
n-Butylbenzene	EPA 524.2	none	Detection	Quarterly***
n-Propylbenzene	EPA 524.2	none	Detection	Quarterly***
Paraldehyde	EPA 524.2	none	Detection	Quarterly***
sec-Butylbenzene	EPA 524.2	none	Detection	Quarterly***
Styrene	EPA 524.2	0.1	Detection	Quarterly***
tert-Butylbenzene	EPA 524.2	none	Detection	Quarterly***
Tetrachloroethane,1,1,1,2-	EPA 524.2	none	Detection	Quarterly***
Tetrachloroethane,1,1,2,2-	EPA 524.2	none	Detection	Quarterly***
Tetrachloroethylene	EPA 524.2	0.005	Detection	Quarterly***
Tetralin	EPA 524.2	none	Detection	Quarterly***
Toluene	EPA 524.2	1	Detection	Quarterly***
Toluene, 2-Isopropyl-	EPA 524.2	none	Detection	Quarterly***
Toluene, 4-Isopropyl-	EPA 524.2	none	Detection	Quarterly***
Trichlorobenzene,1,2,3-	EPA 524.2	none	Detection	Quarterly***
Trichlorobenzene,1,2,4-	EPA 524.2	none	Detection	Quarterly***
Trichloroethane,1,1,1-	EPA 524.2	0.07	Detection	Quarterly***
Trichloroethane,1,1,2-	EPA 524.2	0.005	Detection	Quarterly***
Trichloroethylene	EPA 524.2	0.005	Detection	Quarterly***
Trichlorofluoromethane	EPA 524.2	none	Detection	Quarterly***
Trichloropropane	EPA 524.2	none	Detection	Quarterly***
Trichloropropane,1,2,3-	EPA 524.2	none	Detection	Quarterly***
Trimethylbenzene,1,2,4-	EPA 524.2	none	Detection	Quarterly***
TRIMETHYLBENZENE,1,3,5-	EPA 524.2	none	Detection	Quarterly***
'Vinyl chloride	EPA 524.2	0.002	Detection	Quarterly***
Xylenes	EPA 524.2	10	Detection	Quarterly***

Monthly* - Assumes one (1) sample prior to the commencement of recharge activities and once a month while recharge is occurring.

Bimonthly** Assumes one (1) sample prior to the commencement of recharge activities and if upon consultation with DEQ it is deemed a pollutant of concern, continue monitoring every other month while recharge is occurring.

Quarterly***- Assumes one (1) sample prior to the commencement of recharge activities and every third month while recharge is occurring.

Surface Water Sampling				
Constituent	Analysis Method	NAWQS (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)	Sampling Frequency
Field Parameters				
Specific Conductance	Probe	none	na	Monthly*
pH	Probe	none	na	Monthly*
Temperature	Probe	none	na	Monthly*
Dissolved Oxygen	Probe	none	na	Monthly*
Depth to Water	Probe	none	na	Monthly*
Coliform Bacteria				
Total Coliform	SM 9221B	>0	na	Monthly*
Total Fecal Coliform	SM 9222B	>0	na	Monthly*
E.coli	SM 9223B	>0	na	Monthly*
CLPP		none	na	Monthly*
Common Ions				
Calcium	EPA 200.7	none	na	Monthly*
Sodium	EPA 200.7	none	na	Monthly*
Magnesium	EPA 200.7	none	na	Monthly*
Potassium	EPA 200.7	none	na	Monthly*
Chloride	EPA 300.0	250	na	Monthly*
Bicarbonate	EPA 310.1	none	na	Monthly*
Sulfate	EPA 300.0	250	na	Monthly*
Nutrients				
Nitrate	EPA 353.2	10	na	Monthly*
Nitrite	EPA 353.2	1	na	Monthly*
Total Phosphorus	EPA 365.1	none	na	Monthly*
Herbicides				
2,4-D	immunoassay	0.7	Detection	Monthly*
Alachlor	immunoassay	0.02	Detection	Monthly*
Aldicarb	immunoassay	none	Detection	Monthly*
Atrazine	immunoassay	0.03	Detection	Monthly*
Carbofuran	immunoassay	0.4	Detection	Monthly*
Metolachlor	immunoassay	none	Detection	Monthly*
Magnacide (acrolein)	*immunoassay*	*none*	*Detection*	*After Application*

Monthly* - Assumes one (1) sample prior to the commencement of recharge activities and once a month while recharge is occurring.

Milepost 31 Recharge Site Ground Water Quality Monitoring Plan

1.1 PROJECT DESCRIPTION

1.1.1 Location

The Milepost 31 recharge site is located near the Milner Gooding canal, approximately 31 miles downstream of Milner Dam and approximately 10 miles north of Eden, Idaho (Figure 1). The site is located in sections 1, 2 and 3 of T8S R19E.

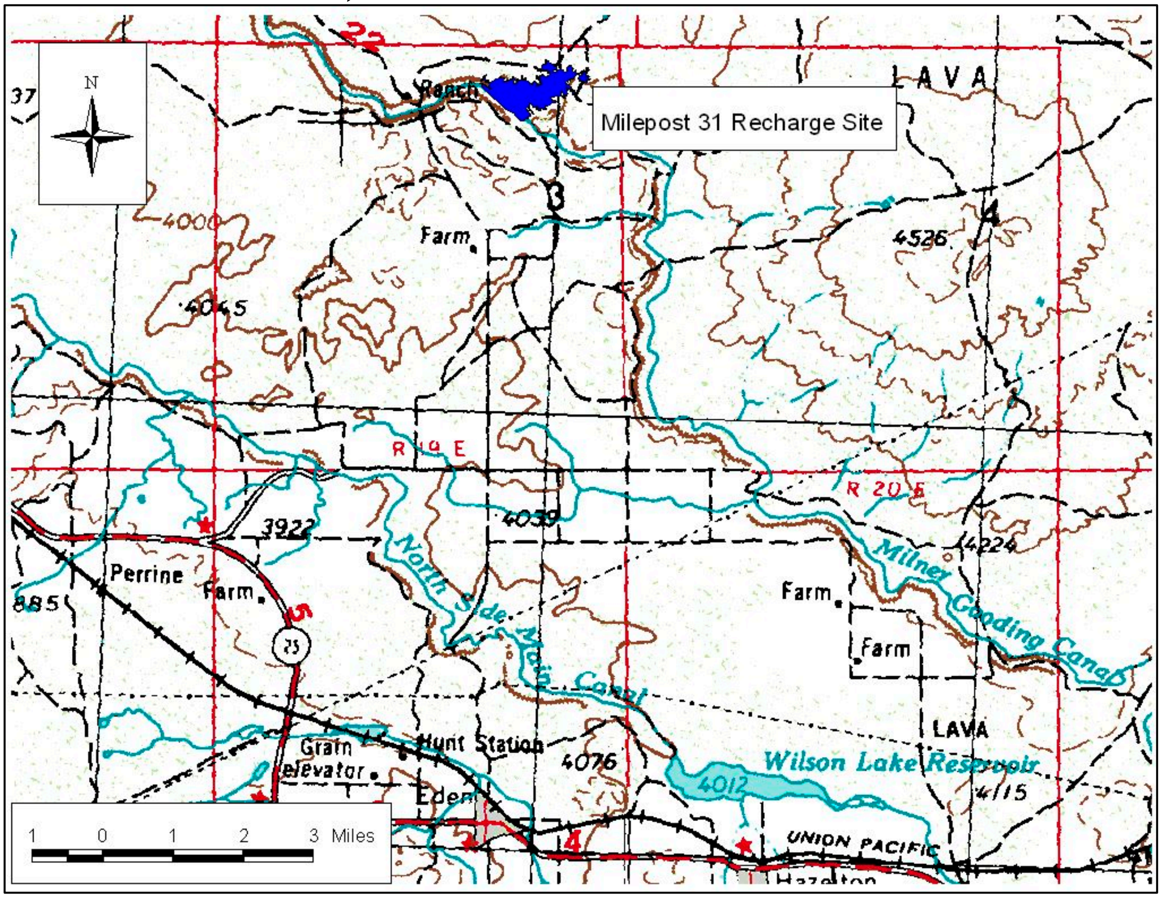

Figure 1: Location map for the Milepost 31 Recharge Site.

1.1.2 Physical Description

The proposed recharge basin lies north of the Milner Gooding Canal and would occupy 60 to 335 acres depending on discharge rates to the recharge site. The basin, as shown in Figure 1, is 335 acres.

1.1.3 Land Ownership

The recharge site is located on land owned and administered by the United States Department of the Interior, (USDI), Bureau of Land Management (BLM).

1.1.4 Project Purpose

The purpose of the project is to provide managed recharge to help maintain and/or restore ground water levels of the Eastern Snake Plain Aquifer (ESPA). The project is anticipated to be one of several coordinated projects implemented across the Eastern Snake River Plain (ESRP).

1.1.5 Expected Outcome

This project has the potential to recharge up to of 72,000 acre-feet/year. No negative impacts on ground water quality are expected from recharge at the site. According to recent modeling recharge at this site, at steady state conditions, would yield to the Snake River as follows:

Ashton to Rexburg	0.8%
Hiese to Shelley	0.9%
Shelley to Near Blackfoot	6.8%
Near Blackfoot to Neely	23.7%
Neely to Milner	6.4%
Devils Washbowl to Buhl	35.5%
Buhl to Thousand Springs	11.7%
Thousand Springs	7.2%
Thousand Springs to Malad	0.8%
Malad	6.1%
Malad to Bancroft	0.2%

1.1.6 Type and Source of Recharge Water

The water to be used for recharge will be diverted from the Snake River into the Milner Gooding Canal and transported to the site. Water will be diverted under water right 01-7054 currently held by the Idaho Water Resource Board. Water could also be secured from the water bank or other appropriate source.

1.1.7 Volume of Recharge Water

Recharge will occur at the recharge site during the time periods and amounts shown in Figure 2. The approximate time frame for recharge would occur between February 15 to May 1 and September 15 to November 31. The recharge rate will vary depending on water availability and the maximum expected recharge is as shown in Figure 2. Peak inflows to the basin are not likely to exceed 250 cubic feet per second (cfs). For the rates and time frame shown in Figure 2, the maximum annual recharge is 72,000 acre-feet.

1.1.8 Project Duration

The proposed project has a lifespan in excess of 20 years. The project will remain active as long as a source of water can be secured and site characteristics remain favorable for managed recharge activities.

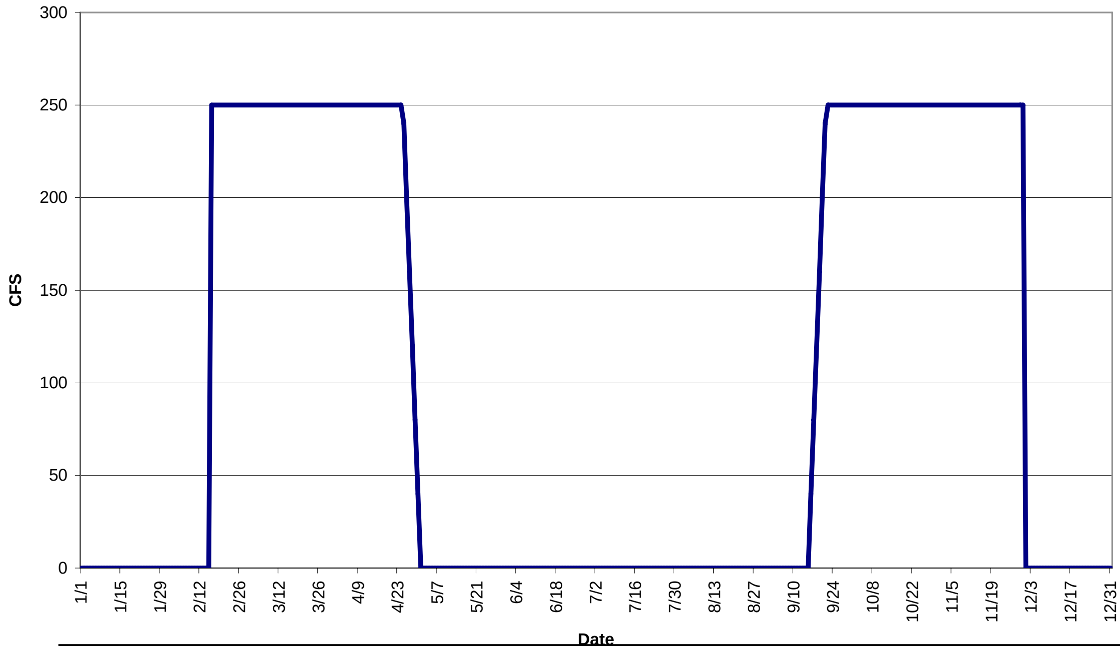

Figure 2: Projected season of use and maximum diversion rates for the Milepost 31 recharge site

1.2 RECHARGE AREA CHARACTERIZATION

1.2.1 Soil and Surficial Geology

1.2.1.a Soils

The majority of the soil map units (Figure 3) are Rock Outcrop-Banbury-Paulville Complex, (map unit symbol 107) with a 2 to 6 percent slope (Ames 1998), and occupy approximately 70 percent (Table 1) of the site. The remaining soil map units are the Power-McCain Complex, 1 to 6 percent slopes (map unit symbol 91).

Basalt outcrops compose up to 28 % of the area and consist of “sharp, angular to semirounded, long narrow ridges ranging to semiround outcroppings that extend 1 foot to 10 feet above the adjacent landscape.” (Ames, 1998) Banbury, and McCain soils comprise 30% of the area and can be found on plane and convex areas. Depth to bedrock in the Banbury soils are 15 inches and the permeability is moderate. Banbury soils probably have the highest permeability due to their shallow depth. McCain soils are moderately deep and permeability is moderately slow.

Paulville and Power soils comprise 36 percent of the area and can be found on concave areas of terraces. Paulville soils are considered very deep with a rooting depth of 60 or more inches. Permeability of the Paulville soils is moderately slow due to a restricting layer from 8 to 31 inches where permeability ranges from 0.2 to 0.6 inches per hour (in/hr).

Power soils are deep soils and permeability is considered moderately slow. Contrasting inclusion comprise the remaining 16 percent of soils at the recharge site.

Soils investigation conducted on site indicate high clay content below 24 inches of soil depth in concave positions on the landscape. This high clay content will reduce soil permeability in these areas.

Water may pond over the Paulville, Power, McCain and contrasting inclusions found in the bottom and terraces of the basin but may infiltrate through rock outcrops depending on the level of water surface.

Basalt outcrops at the site are mostly at or near edges of the basin or on elevated land features. The permeability around and through the basalt outcroppings is not known.

Excluding the basalt outcroppings, the estimated recharge capacity at the site is approximately 250 cubic feet per second (cfs). This figure is based on an average permeability for each mapped soil type. Infiltration in and around basalt outcrops is likely to increase this figure but the extent is unknown (Ames 1998).

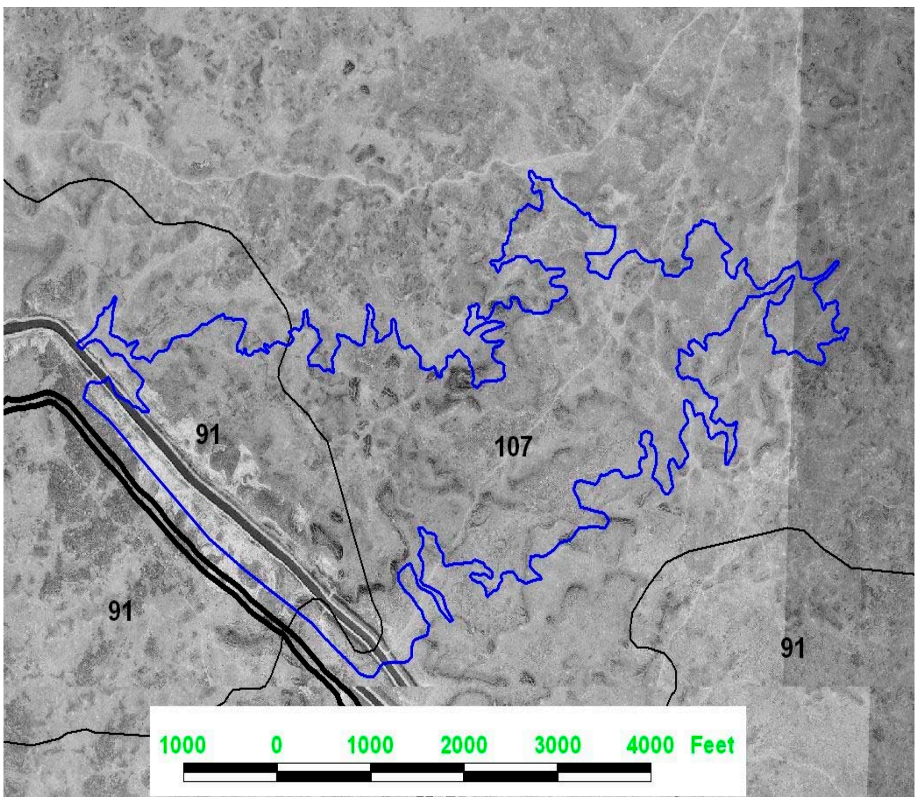

Figure 3: Soils map for the Milepost 31 recharge site, see Table 1 for symbol description

Table 1: Soil map units for the Milepost 31 recharge site

Soil Symbol	Major Map Unit	Acres	Depth (In)	Clay (Pct)	Permeability (In/hr)
91 Power-McCain, 1 to 4 percent slope	Power	50.0	0-14	18-22	0.6-2.0
			14-28	24-35	0.2-0.6
			28-72	15-20	0.6-2.0
	McCain	30.0	0-6	15-22	0.6-2.0
			6-16	18-30	0.2-0.6
			16-23	10-18	0.6-2.0
	Inclusions	20.0			0.6-2.0
107 Rock Outcrop-Banbury-Paulville, 2 to 6 percent slope	Banbury	70	0-5	10-15	0.6-2.0
			5-15	25-33	0.6-2.0
	Paulville	35.0	0-8	15-22	0.6-2.0
			8-31	24-31	0.2-0.6
			31-47	16-24	0.6-2.0
			47-60	10-15	0.6-2.0
	Rock	93.0	-	-	-
	Inclusions	35.0	-	-	2.0-6.0

1.2.1.b Geology

Surficial Geology

The Milepost 31 recharge site is a large natural basin lying on the north side of the Milner Gooding Canal. The canal bank could also act as a “dike” for the recharge basin if water levels were deep enough. The surficial geology is described as Upper Pleistocene Snake Plain Lava Flows. Basalt outcrops and pressure ridges are found throughout the area. Some basalt outcrops do occur within the recharge basin and may, if deemed necessary, require modification prior to recharge activities.

1.2.2.a Vadose Zone Characterization

Two monitoring wells located near the site (see Figure 11, page 87) were surveyed with a down-hole camera prior to the installation of the casing. The characterization of the vadose zone is made using the results of the two camera surveys.

Milepost 31 West Well Camera Survey

The camera survey was halted at 305 feet below top of casing (btoc) because of complete loss of visibility within the water-filled bore.

A single-point resistance log of the saturated portion of the borehole was performed. The steel surface casing was used as the ground for the mud-plug because of the lack of a good surface ground away from the wellhead. The log has been cut off above 270 feet because these logs require a fluid-filled borehole. The measured resistance appears to correlate directly to the enlarged fracture zones with the fractured areas showing decreased resistance. The relatively high resistance between 285 and 300 feet corresponds with the smooth, massive part of the basalt as evidenced by the caliper log.

The induction resistance log is nearly featureless. Except for a few slight excursions at the interflow zones, and a noticeable increase in conductivity below the water table, the log is of little value. The negligible difference in response above and below the water table may indicate tight formations and filled fractures because the air or water-filled porosity would otherwise be reflected in the log response. Increasing moisture content may be reflected by the log's general and gradual decrease in measured resistivity from top of casing to the water table, but this might also be instrument drift. The log does show a response to the interflow zones probably as a result of conductive clays and/or increased moisture content. The absence of a response at the flow top at 100 feet btoc may be due to low moisture content or the relatively thin nature of that unit.

The temperature log was calibrated on-site, just prior to the log, using a thermometer certified to an accuracy of 0.5^0 F. The log is probably only meaningful for bottom hole temperature (56.4^0 F). Variations within the vadose zone are difficult to interpret owing to the recently uncapped well and the wide temperature differential between the open borehole and the outside ambient temperature. The temperature increase at 190 feet resulted from the instrument hanging up on the irregular and rubbly flow top. The log clearly records the static water level at 274 feet btoc.

The upper 20-feet of the borehole is occluded from view behind the 8-inch casing. Approximately 80 percent of the bore is smooth and the same inside diameter as the 8-inch surface casing. The natural gamma-ray response is very low owing to the relative lack of radioactive minerals within basalt lavas. The log does delimit the contact zones between flows. The gamma counts range between 10 and 25 counts per second (cps), over most of the borehole.

From 20 to 62 feet btoc, the hole is relatively featureless massive basalt with few fractures, which appear to be in-filled with mineral or drill cuttings. From 62 to 65 feet btoc there is a rubble zone underlain by more basalt from 65 to 99 feet. These are interpreted as two separate flows based on the rubble zone and a slight change in gamma-ray response (15 to 20 cps and 15 to 30 cps respectively). A slow seep is evident at about 65 feet btoc.

At 99 feet btoc, there is a five-foot section of rubble, sand and clay. This zone is characterized by an enlargement of the borehole to 11.5 inches and a gamma response up to 35 cps. The camera log shows characteristic red oxidation.

From 104 to 170 feet btoc, there is a smooth massive section broken by a broken, blocky zone from 147 to 151 feet btoc. Gamma ray response is 25 to 30 cps.

The interval from 170 to 182 feet btoc is an interflow zone characterized by amygdaloidal (secondary mineralization in vesicles), rubbly basalt with hematite clay, soil, or infilling. The driller described this as broken lava, ash and clay. The caliper log shows an increase in bore diameter to about 14 inches. A pronounced increased radioactive activity is apparent with counts as high as 120 cps. A second slow seep is visible at about 176 feet btoc.

A third vesicular basalt section extends from 182 to 249 feet btoc. The driller described this as medium hard black basalt and the caliper log shows only slight variations in bore diameter, particularly at a cinder zone noted by the driller at 231 to 238 feet btoc. Radioactivity in this section was measured at 10 to 25 cps.

From 249 to 252 feet btoc, the driller reported a cinder zone. The caliper log shows an increase in bore diameter to 10 inches and there was a slight increase in natural gamma response to about 35 cps.

The lowest basalt section in the well consists of medium hard basalt with fractures from 252 to 325 feet btoc. The caliper log indicates some irregularity in the bore diameter corresponding with the fractures, with variances of about 2.5 inches. The water-saturated portion of the well begins at 274 feet btoc and is clearly visible in the point resistance and temperature logs. Natural gamma response is 15 to 25 cps.

Milepost 31 East Well Camera Survey

The camera survey was halted at 191 feet below top of casing (btoc) due to loose and broken, basalt partially blocking the bore. The upper 20 feet of the bore is occluded from view behind the 8-inch casing.

A single-point resistance log of the saturated portion of the borehole was performed. The steel surface casing was used as the electrical ground for the mud-plug because of the lack of a good surface ground away from the wellhead. The log has been cut off above 260 feet because these logs require a fluid-filled borehole. The point resistance decreases steadily below the water table at 269 feet btoc, which may indicate increasing fracture porosity.

The induction resistivity log is nearly featureless. Except for a few slight excursions at the interflow zones, and a noticeable decrease in resistivity below the water table, the log is of little value. The negligible difference in response above and below the water table may indicate tight formations and filled fractures because the air or water-filled porosity should be reflected in the log response. Increasing moisture content may be reflected by the log’s general and gradual decrease in measured resistivity from about 120 feet to the water table, but this might also be instrument drift. The log does show a response to the interflow zones probably as a result of conductive clays and/or increased moisture content.

The temperature log was calibrated on-site, just prior to the log, using a thermometer certified to an accuracy of .5^0 F. The log is probably only meaningful for bottom hole temperature (53.5^0 F). Variations within the vadose zone are difficult to interpret owing to the uncapped well and wide temperature differential between the open borehole and the outside ambient temperature. A steady upward air draft in the bore also adds an element of complexity to the temperature variations. A break in slope at 195 feet btoc may be reflective of the air draft and possibly air-filled permeability. The log clearly records the change in temperature at the static water level at 269 feet btoc.

Approximately 85 percent of the bore is smooth and the same inside diameter as the 8-inch surface casing. The natural gamma-ray response is very low owing to the relative lack of radioactive minerals within basalt lavas. The log does delimit the contact zones between flows. The gamma counts range between 5 and 35 counts per second (cps) over most of the borehole.

From 20 to 65 feet the hole is relatively featureless, massive basalt with few fractures, which appear to be in-filled with mineral or drill cuttings. Beginning at 65 feet btoc, and continuing to 129 feet btoc, the hole has considerable fracture traces with the exception of a smooth massive section from 110-to-114 feet btoc. Although the gamma-ray response is consistent at 10 to 40 cps for this entire interval, it is likely two separate flows similar to the West well.

The interval from 115 to 129 feet btoc is a vuggy, vesicular interflow zone characterized by amygdaloidal, rubbly basalt with hematite clay, soil, or infilling. The driller described this as broken lava, ash and cinders. The caliper log shows an increase in bore diameter to about 11 inches. A single, pronounced radioactive excursion (increased activity) is apparent between 110 and 120 feet btoc with counts as high as 80 cps.

At 129 feet, begins another massive basalt flow to 187 feet btoc. This featureless borehole wall is interrupted by a short (5-foot) and rough vesicular interval between 155 and 160 feet btoc.

At 188 feet btoc, a zone of loose, blocky, scoriacious, and vesicular basalt is present. Here, the hole is out of round and a larger slab of basalt has apparently moved downward (along a fracture plane) and into an enlarged (from drilling) portion of the borehole, partially blocking the hole. The driller described this zone as cinders and soft, broken basalt with a partial loss of cutting returns, extending to about 194 feet btoc. The caliper log shows a widening of the bore to about 18 inches.

A third basalt section extends from 195 to 253 feet btoc. The driller described this as hard basalt and the caliper log shows only very slight variations in bore diameter.

From 254 to 276 feet btoc, the driller reported two cinder zones separated by a medium hard basalt flow. The caliper log shows an increase in bore diameter to 16 inches at about 263 feet btoc. There was no significant natural gamma response in this zone.

The lowest basalt section in the well consists of broken basalt from 277 to 312 feet btoc. The caliper log indicates some irregularity in the bore diameter with variances of about 2 inches. This section also corresponds with the water-saturated portion of the well.

1.2.2.b Aquifer System Characterization

Two pressure transducers and data loggers were installed in the Milepost 31 West well and the Milepost 31 East well on April 24, 2001. The west well is located approximately 1.5 miles downstream of the east well. All water level elevations are measured in feet above sea level.

Milepost 31 West

The initial water table elevation on April 24, 2001 was 3811 and appeared to be on the rising limb of the hydrograph (Figure 4). The water table raised an average of 0.0218 ft/day until it reached a maximum elevation of 3813.9 on September 5, 2001 at which time the water table began to decline. The water table fell at a rate of 0.0275 ft/day and reached a minimum elevation of 3807.2 on May 5, 2002. The water table then rose at a rate of 0.0138 ft/day and until it reached an elevation of 3809.2 on September 29, 2002. The water table then began to fall at and average rate of 0.272 ft/day and the latest data indicated a water table elevation of 3803.478 on May 11, 2003. The water table then rose at an average rate of 0.0098 and peaked on September 8, 2003 at an elevation of 3805.84.

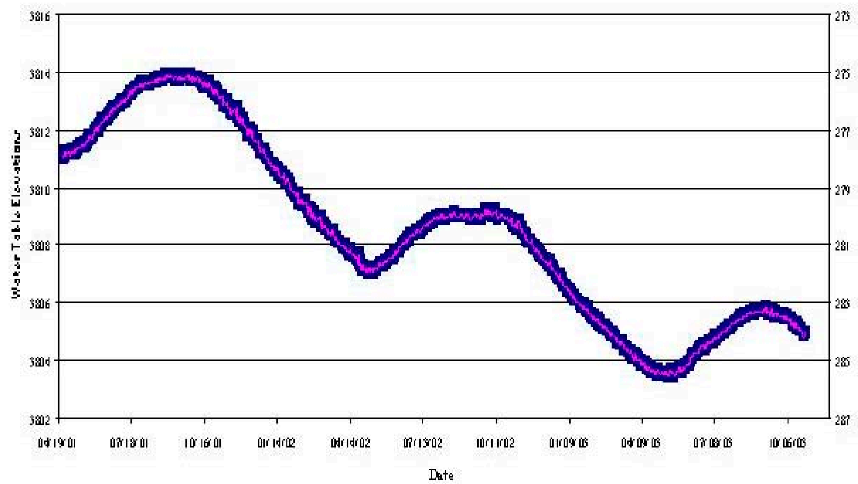

Figure 4: Water table elevations of the Milepost 31 west monitoring well.

There are several differences observed in the wells between water year 2001 and 2002. The maximum water table elevation in 2002 was 4.7 feet lower than 2001. Additionally, the ascension rate was 37 percent lower during the spring of 2002 compared to the spring of 2001. It also appears the water table in 2001 had already started rising when the pressure transducer water was installed on April 24, however, in 2002 the rise in the water table did not start until May 5. This difference if probably due to fact that canal diversions in 2001 began on April 5th and in 2002 did not begin until April 25th. In both years the canal was shut done in early October. It should also be noted that in the fall of 2001 and into the spring 2002 the water table fell faster than it rose in spring and summer of 2001 and spring and summer of 2002.

Milepost 31 East

The initial water table elevation was 3810.6 and appeared to be rising (Figure 5). The water table raised an average of 0.0234 ft/day until it reached a maximum elevation of 3813.7 on September 9, 2001 at which time the water table began to decline. The water table fell at a rate of 0.0264 ft/day and reached a minimum elevation of 3807.1 on May 12, 2002. The water table then rose at a rate of 0.0160 ft/day and until it reached an elevation of 3809.3 on September 29, 2002. The water table then began to fall and reached a minimum elevation of 3803.9 on May 11, 2003. The water table then rose at an average rate of 0.0097 ft/day and peaked at an elevation of 3806.4 on September 8. 2003.

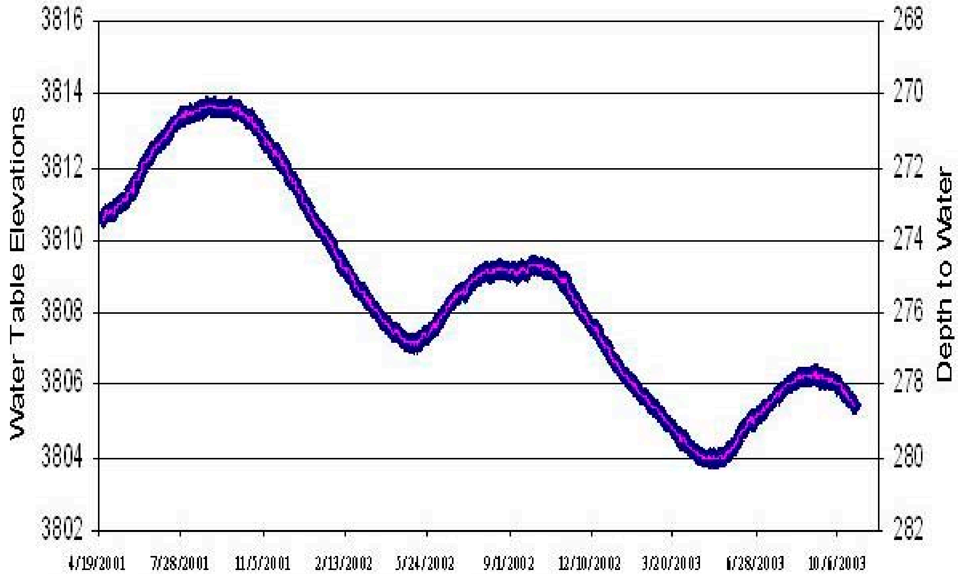

Figure 5: Water table elevations of the Milepost 31 east monitoring well.

There are several differences observed in the wells between water year 2001 and 2002 (Figure 6). The maximum water table elevation in 2002 was 4.4 feet lower than in 2001. Additionally, the ascension rate was 32 percent less during 2002 than 2001. It also appears that the ascension of the water table in 2001 had already started when the pressure transducer water installed on April 24, however, in 2002 the ascension did not start until May 5. This difference if probably due to fact that canal diversions in 2001 began on April 5th and in 2002 did not begin until April 25th. It should also be noted that the recession water in the in 2001 and early 2002 was 13 percent high than the ascension rate of 2001. The ascension rate of the water table in the spring and summer of 2003 was less than for the same time period the preceding year.

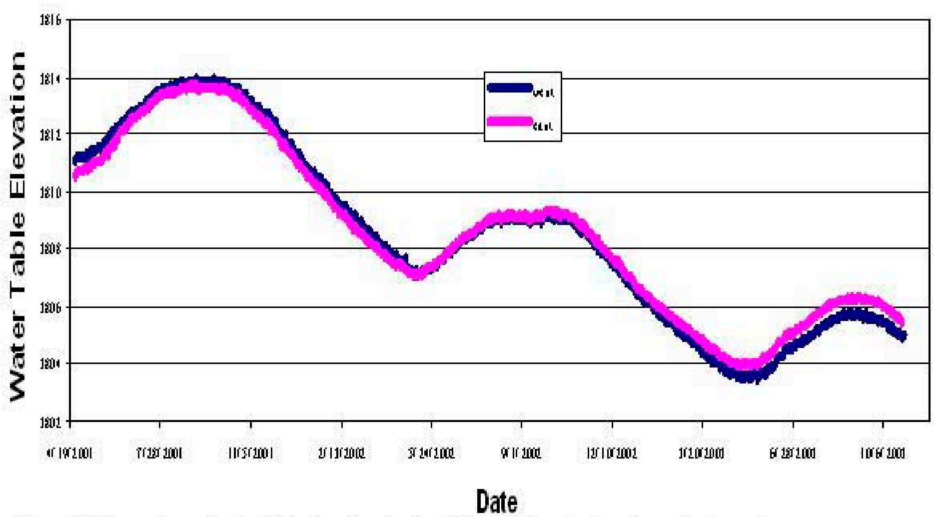

Figure 6: Comparison of water table elevations in the Milepost 31 east and west monitoring wells.

Schmidt and Salovich modeled ground water flow at the Milepost 31 Recharge site using an analytic element flow model. They modeled recharge under both a steady state and transient conditions. The steady state condition assumed an average recharge rate of 475 cfs. The transient condition assumed flows that ranged from zero cfs in the summer to 1400 cfs in the winter. The scenario was run for a maximum of two years. Hydraulic conductivity in the vicinity of the site ranges from 1000 to 11,000 ft/day.

Aquifer responses to the transient and steady state simulations were similar. The "expected distance of the two-year time of travel ranges from 2-5 miles down-gradient from the site depending on the starting point of pathlines" (Schmidt and Salovich 1998) (Figure 7). The expected change in the water level is small. The transient and steady state simulations show less than a five foot change in ground water elevations on the periphery of the basin. In most cases the change in elevation was less than two to three feet. The change in elevation would be imperceptible a few miles down-gradient of the recharge basin.

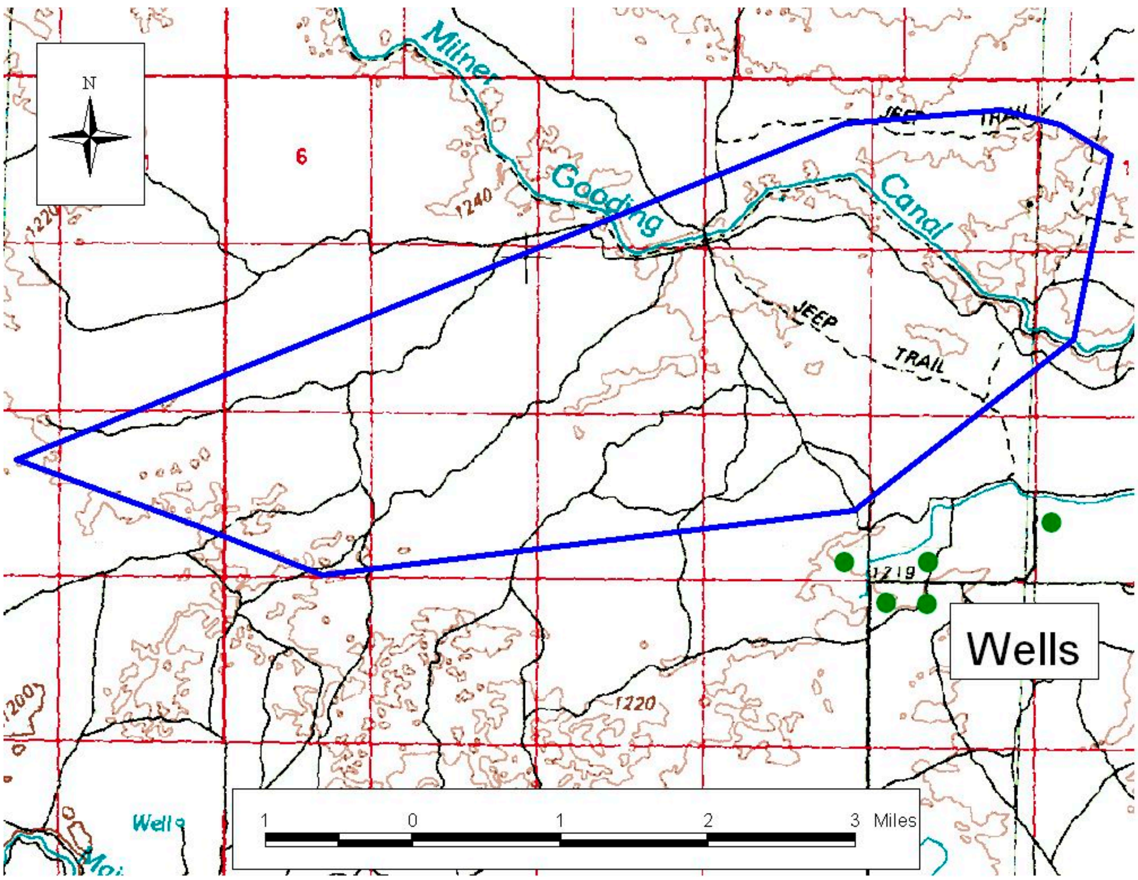

Figure 7: Area of influence after two years of recharge at the Milepost 31 recharge site.

Several wells are located close to the recharge site but are on the periphery of the predicted two-year time of travel. Schmidt and Salvocih (1995) stated that these wells are not likely to be impacted by recharge at the Milepost 31 site. The closest down-gradient well is located approximately seven miles to the southwest of the recharge basin.

1.2.2.c Springs

There are no springs in the vicinity of Milepost 31 recharge site.

1.2.2.d Surface Water Features

The Milner Gooding Canal is the major surface water feature near the Milepost 31 recharge site. Also present in the vicinity of the recharge site are several small seasonal wetland areas (Figure 8). They are generally small closed basins that collect rainfall and snow melt. The operation of the recharge site should have no impacts on those seasonal wetlands.

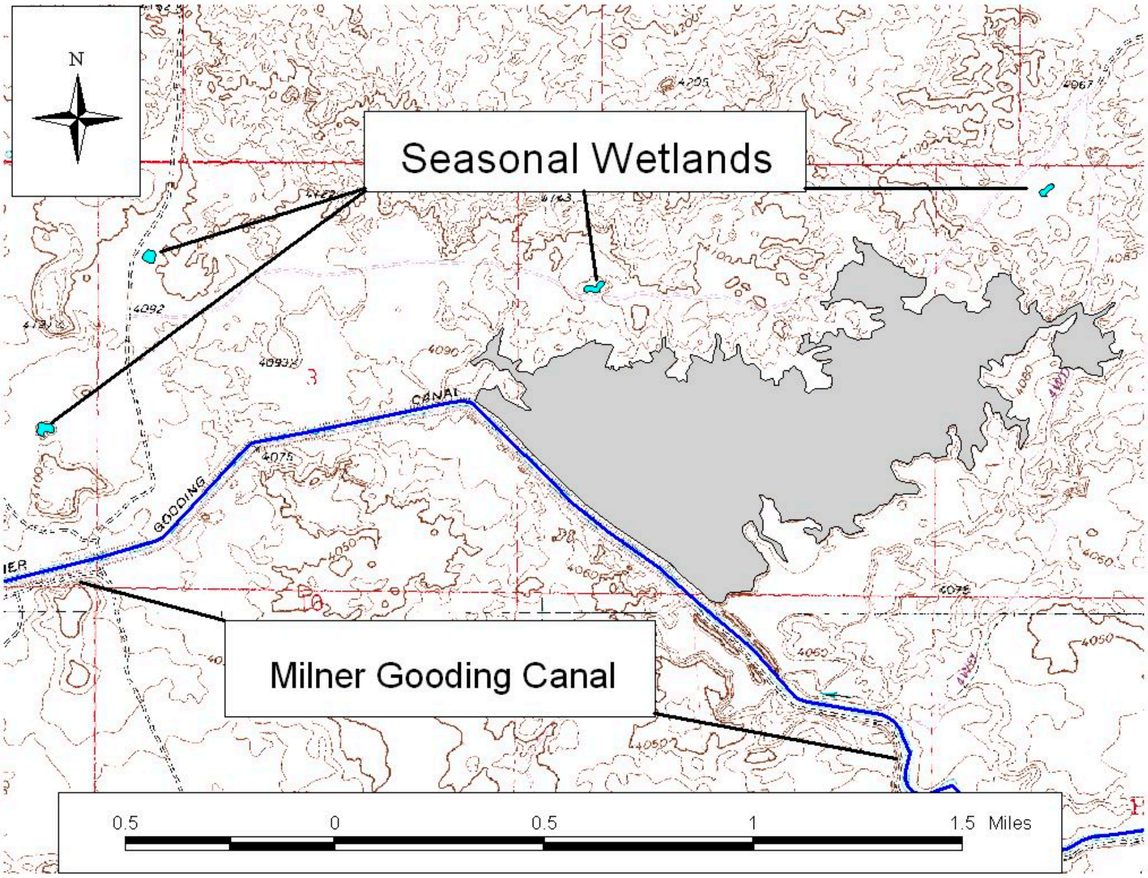

Figure 8: Surface water features near the Milepost 31 recharge site.

1.2.3 Potential Contaminant Sources and Land Use

1.2.3.a Potential Contaminant Sources

There are several potential sources of contamination that could impact operations at the Milepost 31 recharge site (Figure 9). Livestock grazing is common along much of the Milner Gooding Canal. Livestock have access to the canal for approximately 15 miles upstream of the recharge site. In some places livestock access is restricted due to steep canal banks. It appears that while livestock can access the canal for water, the shape of the canal bank and swift current prevent livestock from entering the canal in most areas. Heavy concentrations of livestock near watering points could create a source of bacterial contamination, particularly after heavy rains.

One large dairy is located approximately 10 miles upstream of the recharge site. The dairy is situated down-gradient of the canal is not expected to have an impact on water quality in the canal.

Other potential sources of contamination include the introduction of deleterious material into the Milner Gooding Canal as the result of an accident. One rail line crosses the canal approximately 21 miles upstream of the recharge site. Additionally, Interstate 80 crosses the canal approximately 25 miles upstream of the recharge basin. An accident at either location or other smaller road crossings could result in a spill of hazardous material into the Milner Gooding Canal.

1.2.3.b Land Use

The site is currently owned and managed by the USDI Bureau of Land Management. The area has been used for livestock grazing (Figure 9).

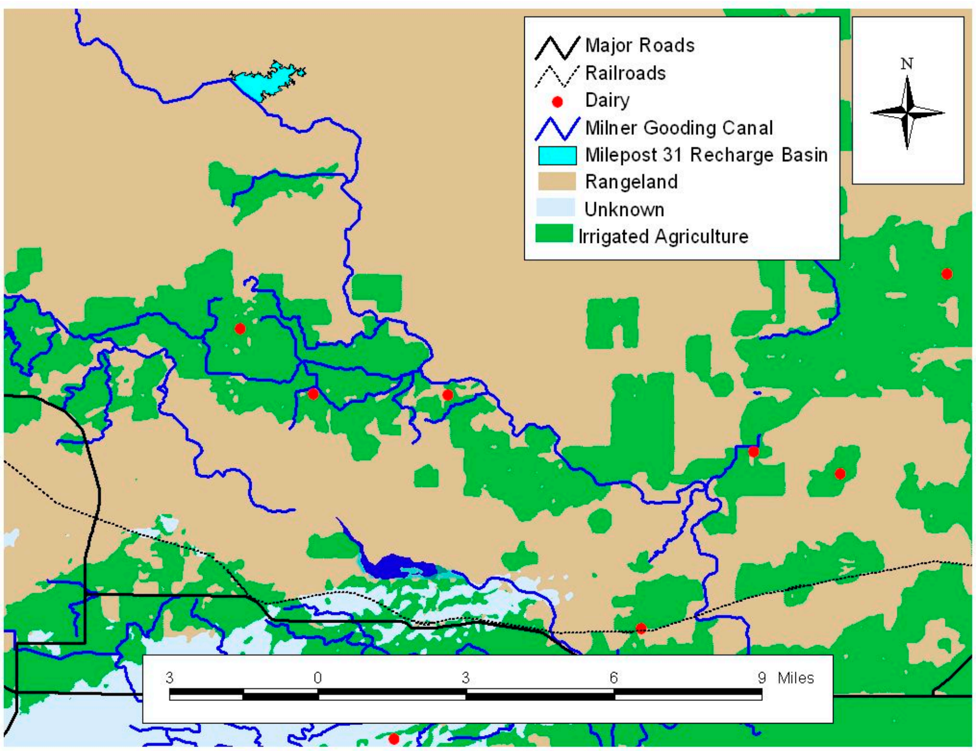

Figure 9: Land use and potential contaminate sources for the Milepost 31 recharge site.

1.2.3.c Vegetative Cover

Potential natural vegetation is bluebunch wheatgrass and Wyoming big sagebrush. Much of the native vegetation has been replaced by annual cheatgrass. Existing vegetation is likely to be replaced by annual communities after the commencement of recharge activities.

1.2.4 Recharge Water Confining Structures

No water confining structures will be needed for this project.

1.3 POTENTIAL IMPACTS

The proposed project is not expected to lower the current quality of ground water in the vicinity of the recharge basins. Current leakage from canals and laterals does not appear to have had a negative impact on water quality. The proposed recharge sites have adequate soil caps to remove most pathenogenic organisms.

Noxious weeds are a potential problem within the recharge basins. Appropriate weed control measures will be taken to insure noxious weeds are controlled. Control measures may include but are not be limited to:

- Mechanical Removal
- Grazing
- Herbicides

Only herbicides that are labeled for use in aquatic environments will be used and will be applied according to label instructions. DEQ will be notified prior to pesticide applications.

This monitoring plan is designed to demonstrate managed recharge does not degrade ground water quality. Surface water and ground water quality will be monitored before, during, and after recharge activities. Monitoring will focus primarily on those constituents that have been identified as potential pollutants of concern. Emphasis is placed on monitoring biological contaminants because these pose acute risks to human health.

1.4 WATER QUALITY MONITORING

1.4.1 Baseline Water Quality

Water quality in the Eastern Snake Plain Aquifer (ESPA) is generally quite good. Except for scattered incidences of elevated nitrates and organic compounds, the water is of suitable quality for domestic supplies without treatment. Because the historical record of water quality sampling is relatively short, it is difficult to determine how man's activities have impacted the aquifer over time.

Wood and Low (1988) estimated that about 5.6 billion cubic meters (m^3) of surface irrigation water entered the aquifer as incidental recharge in 1980. Over one hundred years of irrigation seem to have had little impact on the concentrations of major ions in the ground water. They attribute this lack of impact on the fact that the ion chemistry of the surface water is essentially the same as the ground water, and that even though the amount of water recharged seems large, it is still a small fraction of the total amount of water in the aquifer. Exacerbating the difficulty of identifying changes are the rapid flow rate in the aquifer, and natural variability in the water chemistry.

The basic chemistry does not vary a great deal in the ESPA. Wood and Low (1988) observed that generally the water becomes isotopically heavier with distance from the recharge areas as a result of evapotranspiration, and that carbon-13, calcium and bicarbonate increase with both distance and irrigation-induced carbonate dissolution. Mann and Low (1994) and Bartholomay, *et al* (1997) observed that tritium in the irrigated areas is also enriched as a result of recharge by surface water, while less-developed areas and those irrigated almost exclusively by ground water exhibit tritium values more closely regarded as background.

In order to evaluate the existing ground water quality at the Milepost 31 recharge site, two sets of samples were collected from the East and West monitor wells in 2001 and 2002 (Figure 10). The samples were collected using a 3-liter weighted polyethylene bailer connected to a stainless steel cable and hand-operated winch.

Water quality results for the East and West Monitoring Wells and 17 Statewide Monitoring Program (SMP) wells (Figure 10) located nearest to Milepost 31, and surface water quality data collected by the U.S. Geological Survey at the stream gauge below Milner Dam on the Snake River are summarized in this document. The surface water samples collected at the stream gauge are considered representative of water in the Milner pool since it is the only source of water in the Snake River at that point.

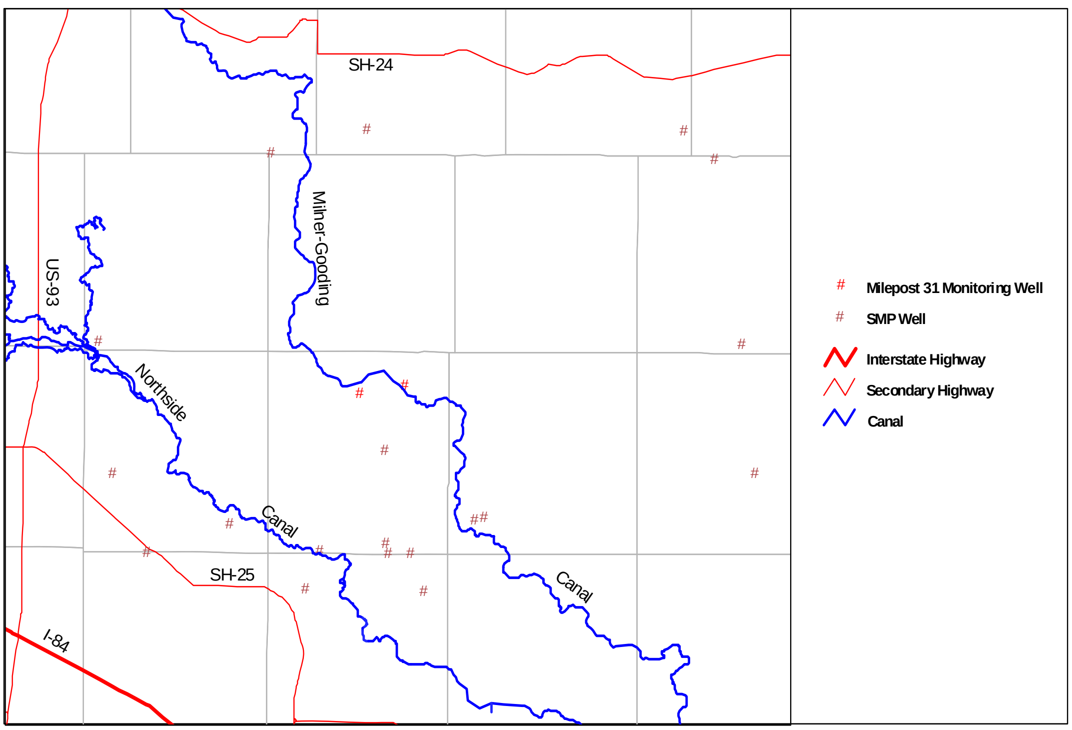

Figure 10: Monitoring and Statewide well locations near Milepost 31, Jerome County, Idaho

The different chemical constituents are compared to Primary and Secondary Constituent Standards for ground water established by the Idaho Department of Environmental Quality (DEQ) under the *Ground Water Quality Rule* (IDAPA 58.01.11).

1.4.1.a General Water Chemistry

Measurements of general water chemistry are summarized in Table 2. For the most part, measurements of constituents in the Milepost 31 monitoring wells, SMP wells and surface water are similar. Dissolved oxygen at one recharge monitoring well was slightly lower than SMP and surface water measurements at 5.2 mg/L. Some surface water samples exceeded the recommended ground-water standard for pH of 8.5 and generally the surface water samples had greater values for pH, dissolved oxygen and temperature (DEQ, 2003).

Table 2. Summary of general water chemistry at Milepost 31, Jerome County, Idaho.

[°C, degrees Celsius; $CaCO_3$, calcium carbonate; SCS, Secondary Constituent Standard; µs/cm, microsiemen per centimeter; mg/l, milligram per Liter; --, no value available]

General Water Chemistry	Milepost 31 Well Ranges	SMP Well Ranges	Surface Water Ranges	Ground-Water Standard	Standard Type
Alkalinity, mg/l as $CaCO_3$	123 - 141	115 - 434	123 - 198	--	--
Dissolved Oxygen, mg/l	5.2 - 7.5	5.8 - 9.0	8.0 - 14.6	--	--
Hardness, total, mg/l as $CaCO_3$	135 - 154	115 - 480	120 - 219	--	--
pH, standard units	7.7 - 7.9	7.5 - 8.2	7.3 - 9.0	6.5 - 8.5	SCS[1]
Specific Conductance, µs/cm at 25°C	387 - 396	302 - 1240	314 - 575	--	--
Water Temperature, °C	12.5 - 13.6	11.8 - 17.1	4.0 - 20.5	--	--

[1]IDAPA 58 Title 01 Chapter 11

Inorganic Constituents

The inorganic constituents detected in the Milepost 31 area include arsenic, barium, bicarbonate, boron, calcium, chloride, chromium, fluoride, lithium, magnesium, manganese, potassium, selenium, silica, sodium, and sulfate. Concentrations for constituents exceeding the reporting level in recharge monitoring wells are summarized in Table 3 along with established constituent standards.

The chemical composition of the monitoring wells, nearby SMP wells, and the surface water is generally similar and there have been no analyses that have exceeded established ground water quality standards. The surface water analyses frequently show a wider range in constituent concentrations and often have a greater maximum concentration.

Table 3. Summary of inorganic constituents detected in water at Milepost 31, Jerome County, Idaho
[E, estimated; mg/l, milligrams per liter; µg/l, micrograms per liter; PCS, Primary Constituent Standard; SCS, Secondary Constituent Standard; --, no value available]

Constituent	Milepost 31 Well Ranges	SMP Well Ranges	Surface Water Ranges	Ground-Water Standard	Standard Type
Arsenic, µg/l as As	E1.9 - 2.5	1.0 - 19.7	2.0 - 4.0	50	PCS[1]
Bicarbonate, mg/l as HCO_3	150 - 170	140 - 529	120 - 220	--	--
Barium, µg/l as Ba	20.8 - 41.8	14.0 - 17.7	49.0 - 82.0	2000	PCS[1]
Boron, µg/l as B	29 - 52	--	--	--	--
Calcium, mg/l as Ca	34 - 38	25 - 68	29 - 59	--	--
Chloride, mg/l as Cl	18.7 - 23.1	8.0 - 73.6	11.2 - 44.0	250	SCS[1]
Chromium, µg/l as Cr	2.6 - 3.1	1.0 - 4.0	<1	100	PCS[1]
Fluoride, mg/l as F	.6 - .7	.3 - .7	.5 - .9	4	PCS[1]
Lithium, µg/l as Li	25.2 - 31.0	--	--	--	--
Magnesium, mg/l as Mg	12.3 - 14.1	13.0 - 75.8	11.5 - 21.0	--	--
Manganese, µg/l as Mn	1.2 - 10.0	1.0 - 3.0	<1.0 - 10.0	50	SCS[1]
Potassium, mg/l as K	3.5 - 4.6	2.9 - 6.9	2.5 - 7.9	--	--
Selenium, µg/l as Se	0.4 - 0.8	0.6 - 4.4	<1	50	PCS[1]
Silica, mg/l as SiO_2	31/0 - 32.0	28.0 - 38.0	6.7 - 27.0	--	--
Sodium, mg/l as Na	13.8 - 18.4	14.0 - 91.1	11.5 - 21.0	--	--
Sulfate, mg/l as SO_4	31 - 32	19 - 116	24 - 64	250	SCS[1]

[1]IDAPA 58 Title 11 Chapter 11

Nutrient and Bacteria Constituents

Dissolved nitrite plus nitrate are collectively referred to as nitrate and result from a wide variety of natural and anthropogenic processes, although the natural processes are almost always a minor contributor to the overall nitrate levels. Nitrate levels in the analyses are below the maximum contaminant level for drinking water (MCL) of 10 mg/L, but often exhibit some impact from man's activities on the surface. Orr and others (1991) estimated that natural concentrations of nitrate in the ESRP range from 0 to 1.4 mg/l.

Phosphorus is an important nutrient in plants and its occurrence in ground water can again be attributed to a wide variety of natural processes and human activities. High concentrations can promote eutrophication of water bodies. Concentrations in all analyses are low and are more likely to be related to man's activities than natural dissolution of the aquifer matrix.

Coliform bacteria are an indicator of possible pollution by intestinal bacterial or viruses, while fecal coliform bacteria almost always indicate the presence of waste from warm-blooded organisms. The surface water samples frequently contained significant numbers of fecal coliform bacteria colonies up to 66 colonies per 100 milliliters (Table 4), and were observed in ground-water samples only twice.

The background level of Cryptosporidium and Giardia in ground water at the site is unknown.

Table 4. Summary of nutrient constituents detected in water at Milepost 31, Jerome County, Idaho.
[col/100 ml, colony forming unit per 100 milliliters; PCS, Primary Constituent Standard; mg/l, milligram per liter; --, no value available]

Constituent	Milepost 31 Well Ranges	SMP Well Ranges	Surface Water Ranges	Ground-Water Standard	Standard Type
Nitrate + Nitrite, mg/l as N	.531 - .740	.36 - 2.4	<.05 - 1.5	10	PCS[1]
Orthophosphorous, mg/l as P	<.02 - .025	<.01 - .05	--	--	--
Phosphorous, mg/l as P	.013 - .081	<.01 - .28	<.01 - .03	--	--
Total Coliform Bacteria, col/100 ml	<1	--	--	1	PCS[1]
Fecal Coliform Bacteria, col/100 ml	<1	<1 - 7	<1 - 66	--	--

[1]IDAPA 58 Title 01 Chapter 11

Radioactivity and Tritium

Gross alpha and gross beta radioactivity come from a wide variety of naturally-occurring and man-made radionuclides, but are reported as if it were all given off by one radionuclide, in this case Thorium-230 and Cesium-137 respectively. This is for reporting convenience only and does not imply that the radioactivity is attributed to these specific isotopes. The results are reported as a concentration plus or minus an uncertainty three standard deviations (3s). For these data, there is a 99-percent probability that the true concentration is in the range of the reported concentration plus or minus the uncertainty. Additionally, if the reported concentration is less than the uncertainty, it is considered to be below the reporting level.

Gross alpha and gross beta particle radioactivity was measured in samples from the recharge monitoring wells and SMP wells. Tritium was also measured in samples from recharge monitoring wells, selected USGS monitoring wells in Jerome County, and one surface water sample (Table 5). None of the samples exceeded the respective ground water quality standards.

Table 5. Summary of radioactivity and tritium detected in water at Milepost 31, Jerome County, Idaho.
[pCi/l, picocuries per liter; PCS, Primary Constituent Standard; --, no value available]

Constituent	Milepost 31 Well Ranges	SMP Well Ranges[1]	Surface Water Ranges	Ground-Water Standard	Standard Type
Gross Alpha Radioactivity, pCi/l as Thorium-230	5.4±4.1 - .9.3±6.9	.9±4.1 - 3.7±6.3	--	15	PCS[2]
Gross Beta Radioactivity, pCi/l as Cesium-137	6.3±2.3 - 8.3±3.6	3.1±2.3 - 8.9±4.7	--	[3]	PCS[2]
Tritium, pCi/l	1±6 - 9±9	1±1 - 110±7	43±3	20,000	PCS[2]

[1]Tritium data from U.S. Geological Survey monitoring wells in Jerome County, ID
[2]IDAPA 58 Title 01 Chapter 11
[32]4 millirems/year effective dose equivalent (Cesium-137 dose equivalent equals 120 pCi/l)

Volatile Organic Compounds and Pesticides

Volatile organic compounds (VOCs) and pesticides are not commonly found in ground water in the Eastern Snake River Plain aquifer. In samples collected from the Milepost 31 monitoring wells, no VOCs were identified in either year of sampling. Samples from three SMP wells near Milepost 31 were found to contain VOCs including benzene, chloromethane, dichlorodifluoromethane, ethylbenzene, isodurene, toluene, and xylenes. None of the surface water samples were analyzed for VOCs.

Table 6 lists the VOCs that were not detected in any samples.

Table 6. Volatile organic compounds not detected in water at Milepost 31, Jerome County, Idaho.

Volatile organic compounds not detected			
1,1-Dichloroethane	1,2,3-Trichlorobenzene	n-Butylbenzene	Dichloromethane
1,1-Dichloroethylene	1,2,3-Trichloropropane	sec-Butylbenzene	Hexachlorobutadiene
1,1-Dichloropropene	1,2,4-Trichlorobenzene	tert-Butylbenzene	Isopropylbenzene
1,1,1-Trichloroethane	1,2,4-Trimethylbenzene	Carbon Tetrachloride	p-Isopropyltoluene
1,1,1,2-Tetrachloroethane	1,3-Dichloropropane	Chlorodibromomethane	Methyl Tert Butyl Ether (MTBE)
1,1,2-Trichloroethane	e,z-1,3-Dichloropropene	Chloroethane	Monochlorobenzene
1,1,2,2-Tetrachloroethane	1,3,5-Trimethylbenzene	Chloroform	Naphthalene
1,2-Dibromoethane (EDB)	2,2-Dichloropropane	o-Chlorotoluene	n-Propylbenzene
1,2-Dichloroethane	Bromobenzene	p-Chlorotoluene	Styrene
cis-1,2-Dichloroethylene	Bromochloromethane	Dibromomethane	Tetrachloroethylene
trans-1,2-Dichloroethylene	Bromodichloromethane	m-Dichlorobenzene	Trichloroethylene
1,2-Dichloropropane	Bromoform	o-Dichlorobenzene	Trichlorofluoromethane
1,2-Dibromo-3-chloropropane (DBCP)	Bromomethane	p-Dichlorobenzene	Vinyl Chloride

Analyses of samples for pesticides were conducted in 2001 and 2002. Because the analyses were done by different laboratories, the list of pesticides varied slightly between the two years.

Table 7 lists the pesticides that were not detected in any samples. No samples for analyses from the Milepost 31 monitoring wells had identifiable concentrations of pesticides. Samples collected from three SMP wells near Milepost 31 contained pesticides identified as atrazine, desethylatrazine, s-ethyl-dipropylthiocarbamate (EPTC, also known as *Eptam*), and metolochlor. Atrazine, desethylatrazine, EPTC, dacthal, and simazine were found in three surface water samples.

Table 7. Pesticides and degradation products not detected in water at Milepost 31, Jerome County

Pesticides Not Detected			
2,3,4,5-Tetrachlorophenol	Carboxin	Ethoprop	Parathion
2,3,4,6-Tetrachlorophenol	Chloramben	Etridiazole	Pebulate
2,4-D	Chlordane-alpha	Fenamiphos	Pendamethalin
2,4-DB	Chlordane-gamma	Fenarimol	Pentachlorophenol
2,4-DCBA	Chlorneb	Fenuron	cis-Permethrin
2,4,5-T	Chlorobenzilate	Fluometuron	trans-Permethrin
2,4,5-TP (Silvex)	Chlorothalonil	Fonofos	Phorate
2,4,5-Trichlorophenol	Chlorpropham	Heptachlor	Picloram
2,4,6-Trichlorophenol	Chlorpyrifos	Heptachlor epoxide	Profluralin
2,6-Diethylaniline	Cyanazine	Hexachlorobenzene	Prometon
3,5-Dichlorobenzoic acid	Cycloate	Hexazinone	Prometryn
4,4-DDD	Dalapon	Ioxynil	Pronamide
4,4-DDE	DCPA	Lindane	Propachlor
4,4-DDT	Desisopropyl Atrazine	Linuron	Propanil
Acetachlor	Diallate	Malathion	Propargite
Acifluorfen	Diazinon	MCPA	Propazine
Alachlor	Dicamba	Metalaxyl	Propham
Aldrin	Dichlobenil	Methidathion	Siduron
Ametryn	Dichloroprop	Methoxychlor	Simetryn
Atraton	Dichlorvos	Methyl paraoxon	Stirofos
Azinphos methyl	Diclofop methyl	Methyl parathion	Tebuthiuron
Benfluralin	Dieldrin	Metribuzin	Terbacil
Benthiocarb	Dinoseb	Mevinphos	Terbufos
Bentatzn	Diphenamid	MGK 264	Terbutryn
BHC-alpha	Disulfoton	MGL 264	Tralkoxydim
BHC-beta	Endosulfan I	Molinate	Triademefon
BHC-delta	Endosulfan II	Monuron	Triallate
Bromacil	Endosulfan sulfate	Napropamide	Triclopyr
Bromoxynil	Endrin	trans-Nonochlor	Tricyclazole
Butachlor	Endrin aldehyde	Norflurazon	Trifluralin
Butylate	Ethalfluralin	Oxyfluorfen	Vernolate
Carbaryl			

Waste Water Contaminants

In 2001, the laboratory providing analyses for pesticides noted two tentatively identified compounds (TICs) in samples from both Milepost 31 wells. The greatest instrument response was attributed to tri(2-chloroethyl)phosphate, commonly known as Fyrol; a compound used as a flame retardant primarily in the manufacture of foam rubber products. A lesser response was attributed to an ultraviolet stabilizer used in plastics, 2-(2-hydroxy-5-methylphenyl)-benzotriazole, commonly known as Tinuvin-p. The laboratory was unable to quantify the concentrations of the compounds. In 2002, samples were collected and analyzed by an analytical protocol developed by the USGS for wastewater contaminants including hormones, pharmaceuticals, and other organic chemical compounds newly recognized as potential contaminants in surface water (Table 8).

While Tinuvin-p was not included in the wastewater analysis, the presence of Fyrol was confirmed in samples from both Milepost 31 wells at 94 and 610 micrograms per liter (μg/L). The presence of these compounds in the samples is not well understood. There appears to be no adequate explanation for the occurrence of Fyrol in the wells. Barnes and others (2002) noted that Fyrol is commonly found in surface water samples throughout the United States but there is little data with respect to its presence in ground water. The Tinuvin-p could be related to the use of plastic well liners or sampling devices, but the results from other wells using the same components and analyzed by the same labs/protocols are not consistent with that conclusion. None of the other wastewater compounds were detected in the samples.

Table 8. Waste water compounds analyzed in water at Milepost 31, Jerome County, Idaho

Waste Water Constituents		
1,4-Dichlorobenzene	Camphor	d-Limonene
1-Methylnaphthalene	Carbaryl	Menthol
17-beta-Estradiol	Carbazole	Metalaxyl
17a-beta-Estradiol	Chlorpyrifos	Methyl salicylate
2,6-Dimethylnaphthalene	Cholesterol	Metolachlor
2-Methylnaphthalene	Cotinine	Monoethoxyoctylphenol
3-beta-Coprostanol	p-Cresol	N,N-diethyl-meta-toluamide
3-Methyl-1(H)-indole (Skatole)	Diazinon	Naphthalene
3-tert-Butyl-4-hydroxy anisole (BHA)	Dichlorvos	para-Nonylphenol
4-Cumylphenol	Diethoxynonylphenol	Pentachlorophenol
4-n-Octylphenol	Diethoxyoctylphenol	Phenanthrene
4-tert-Octylphenol	Equilenin	Phenol
5-Methyl-1H-benzotriazle	Estrone	Prometon
Acetophenone	Fluoranthene	Pyrene
Acetyl hexamethyl tetrahydronaphthalene	Fyrol CEF	beta-Sitosterol
Anthracene	Fyrol PCF	beta-Stigmastanol
Anthraquinone	Hexadydrohexamethylcyclopentabenzopyran	Tetrachloroethylene
Benzo[a]pyrene	Indole	Tris (2-butoxyethyl) phosphate
Benzophenone	Isoborneol	Tributyl phosphate
Bisphenol A	Isophorone	Triclosan
Bromacil	Isopropylbenzene	Triethyl citrate
Bromoform	Isoquinoline	Triphenyl phosphate
Caffeine		

1.4.2 Water Quality Monitoring Locations

Two monitor wells (East and West) have been constructed to monitor ground water quality at the recharge site (Figure 11). The monitor wells should provide information on ground water quality at the recharge site, down-gradient from the recharge basin, and would allow ground water quality concerns to be identified as soon as possible. The downgradient well was placed between 180 and 270 days travel time downstream of the recharge basin (Schmidt and Salovich 1998). Surface water samples will be taken at the headgate for the recharge site to characterize surface water quality.

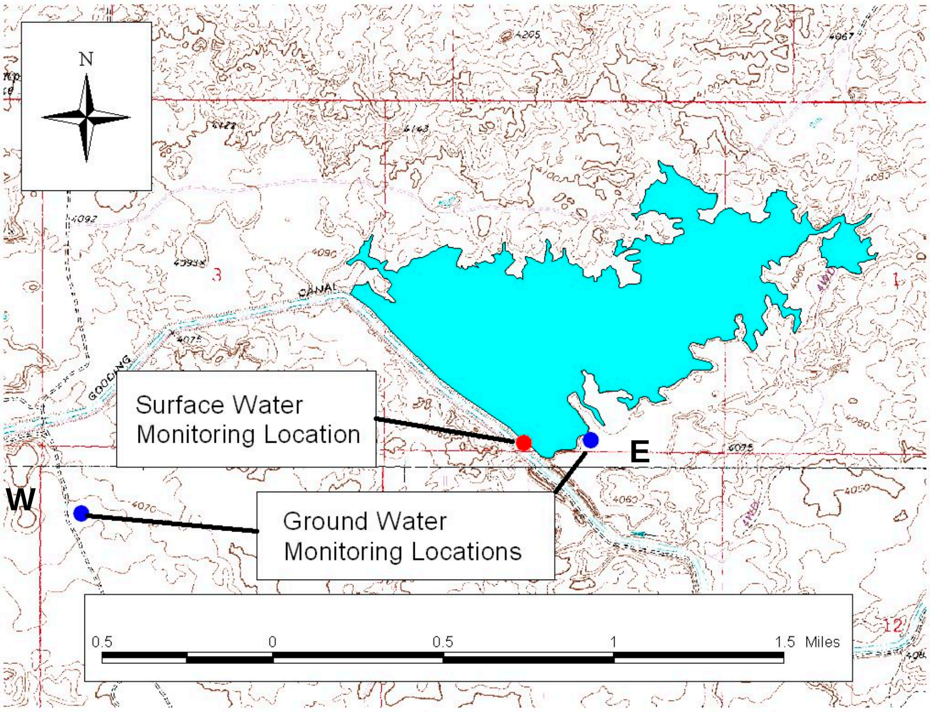

Figure 11: Locations of ground water and surface water monitoring sites for the Milepost 31 recharge site

Water Quality Monitoring Parameters and Frequency

Attachment 1 provides the monitoring parameters, analysis method, the Idaho Ground Water Quality Standard, alert level and frequency for surface and ground water monitoring for the Milepost 31 recharge site.

The operator shall keep appropriate records to determine the volume of water diverted into the recharge site. Those records should contain the amount of water diverted and any changes by date of the amount of water diverted into the recharge site, the yearly commencement date of recharge activities, the yearly termination date of recharge activities and the total volume (in acre-feet) of water diverted into the recharge site.

Surface water quality samples will be collected near the point of diversion into the recharge basin. A plastic disposable device will be used to collect a grab sample at an interval of zero (0) to two (2) feet from the surface of the canal. Sample bottles will be directly filled and appropriate preservatives will be added.

Ground water samples will be taken be taken from the monitoring well via bailing techniques.

Samples will be collected in a manner consistent with the Statewide Ambient Ground Water Quality Monitoring Program (Statewide Program). Samples will be submitted to the Idaho State Bureau of Laboratories in Boise for analysis. Samples will be shipped according to standard operating procedures with appropriate sample labels. If samples are collected for VOC analysis, a trip blank will be included with the sample for testing after shipment. Statewide Program SOPs are available from Idaho Department of Water Resources (IDWR).

1.5 MANAGEMENT PRACTICES

1.5.1 Reporting Schedule

The laboratory will notify the sampling entity as soon as possible if bacteria or pathogens are present in the ground water samples. If any constituent exceeds the alert values in the section entitled Alert Levels, the operator will suspend recharge and notify the IDWR and IDEQ immediately and a confirmatory sample will be collected within three (3) days receipt of the laboratory notification. IDWR and IDEQ will consult on contingency actions to include but not be limited to: immediate suspension of all recharge activities, request additional confirmatory sampling, require additional analysis to determine the probable source of contamination. If IDWR and IDEQ determine that recharge activities may continue, the operator may be required to do additional source water monitoring. Any sampling that exceeds alert levels will be noted in an annual monitoring report.

The operator of the recharge site will develop an annual report to be forwarded to the Idaho Department of Water Resources and the Idaho Department of Environmental Quality. The report will include the following elements in a format suitable to IDWR:

1. Records of the examination of the recharge basin for deleterious material prior to the commencement of recharge activities.
2. Records of the date recharge activities commence, the rate of diversion (in cfs) and the volume of water (in ac-ft) diverted into the recharge basin.
3. Date and time of each sample collected.
4. Data sheets containing the analysis of each sample.

1.5.2 Contingency Plan

American Falls Reservoir District #2 (AFRD#2) does not treat this portion of the canal for in channel vegetation. The high velocity in the canal keeps unwanted vegetation to a minimum.

In the event of other critical events such as a herbicide, gas or diesel spill, the headgate to the recharge site will be closed and remain closed until authorization is provided by DEQ that recharge operations may resume. AFRD#2 will notify the operator of the recharge in the event of a spill into the canal system during periods of recharge. AFRD#2 has responded to accidents on the canal in past and works to prevent hazardous materials from entering private lands or public waters.

1.5.3 Recharge Water Treatment

The recharge water will receive no treatment prior to recharge

General Conditions

This plan will be adhered to during the operation of the managed recharge site. The operator of the site will carry all out monitoring activities and will follow reporting procedures required in the plan. Changes to monitoring constituents and monitoring frequency can be made if upon consultation with IDWR and IDEQ those constituents are not considered to be a threat to ground water quality. Changes to the monitoring plan can be recommended based upon the results of previous monitoring.

Any changes to this plan will require sixty (60) days written notice prior to the commencement of recharge activities by any signatory to this plan and must be agreed to by the other signatories to this plan.

Monitoring reports will be filed with IDWR and IDEQ on a yearly basis except in those instances where immediate notification of IDWR and IDEQ is required. Monitoring reports will be mailed to IDWR at:

Managed Recharge Coordinator
Idaho Department of Water Resources
PO Box 83720
Boise, ID 83720-0098
1-208-287-4840

and with DEQ at:

Managed Recharge Coordinator
Idaho Department of Environmental Quality
601 Pole Line Rd., Suite 2
Twin Falls, ID 83301
1-208-736-2190, or
1-208-539-9757

References:

Ames, Dal., 1998. Soil Survey of Jerome County and Part of Twin Falls County, Idaho. USDA, Natural Resources Conservation Service in cooperation with USDI, Bureau of Land Management; University of Idaho, College of Agriculture, and Idaho Soil Conservation Commission.

Barnes, K. K., Kolpin, D. W., Meyer, M. T, Thurman, E. T., Furlong, E. T., Zaugg, S. D., and Barber, L. B., 2002, Water-quality data for pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000: U. S. Geological Survey Open-File Report 02-94, available on the World Wide Web at URL http://toxics.usgs.gov/pubs/OFR-02-94/index.html.

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Mann, L. J., and Low, W. H., 1994, Tritium, stable isotopes and nitrogen in flow from selected springs that discharge to the Snake River, Twin Falls-Hagerman area, Idaho, 1990-1993: U. S. Geological Survey Water-Resources Investigation Report 94-4247, 21 p.

Orr, B. R., Cecil, L. D., and Knobel, L. L., 1991, Background concentrations of selected radionuclides, organic compounds, and chemical constituents in ground water in the vicinity of the Idaho National Engineering Laboratory: U. S. Geological Survey Water-Resources Investigation Report 91-4015, 52 p.

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Wood, W. W., and Low, W. H., 1988, Solute geochemistry of the Snake River Plain regional aquifer system, Idaho and eastern Oregon: U. S. Geological Survey Professional Paper 1408-D, 79 p.

U. S. Geological Survey, 2003, National Water Information System (NWISWeb) data available on the World Wide Web, accessed July 10, 2003, at URL http://waterdata.usgs.gov/nwis/.

U. S. Bureau of Reclamation , R., 1998, Analytic Element Flow Model of the Milepost 31 Recharge Site using Mflow AEM model developed by R. Schhmidt and M. Salovich, TCTC, 1995

Attachment 1
Monitoring Parameters

Groundwater Sampling				
Constituent	Analysis Method	Idaho Ground Water Quality Standard (mg/l unless otherwise specified)	Alert Level (mg/l unless otherwise specified)	Sampling Frequency
Field Parameters				
Specific Conductance	Probe	none	na	Monthly*
pH	Probe	none	na	Monthly*
Temperature	Probe	none	na	Monthly*
Dissolved Oxygen	Probe	none	na	Monthly*
Depth to Water	Probe	none	na	Monthly*
Coliform Bacteria				
Total Coliform	SM 9221B	>0	Detection	Monthly*
Total Fecal Coliform	SM 9222B	>0	Detection	Monthly*
E.coli	SM 9223B	>0	Detection	Monthly*
CLPP		none	na	Upon Request
Giardia and Crytosporidium	EPA 1623	>0	Detection	Upon Request*
Common Ions				
Calcium	EPA 200.7	none	na	Bimonthly*
Sodium	EPA 200.7	none	na	Bimonthly*
Magnesium	EPA 200.7	none	na	Bimonthly*
Potassium	EPA 200.7	none	na	Bimonthly*
Chloride	EPA 300.0	250	125	Bimonthly*
Bicarbonate	EPA 310.1	none	na	Bimonthly*
Sulfate	EPA 300.0	250	125	Bimonthly*
Nutrients				
Nitrate	EPA 353.2	10	5	Bimonthly*
Nitrite	EPA 353.2	1	1	Bimonthly*
Total Phosphorus	EPA 365.1	none	na	Bimonthly*
Pesticides				
2,4-D	immunoassay	0.7	Detection	Bimonthly*
Alachlor	immunoassay	0.02	Detection	Bimonthly*
Aldicarb	immunoassay	none	Detection	Bimonthly*
Atrazine	immunoassay	0.03	Detection	Bimonthly*
Carbofuran	immunoassay	0.4	Detection	Bimonthly*
Metolachlor	immunoassay	none	Detection	Bimonthly*
Magnacide (acrolein)	immunoassay	none	Detection	After Application

(continued)

Groundwater Sampling (cont)				
Constituent	***Analysis Method***	***Idaho Ground Water Quality Standard (mg/l unless otherwise specified)***	***Alert Level (mg/l unless otherwise specified)***	***Sampling Frequency***
VOCs				
Benzene	EPA 524.2	0.005	Detection	Quarterly***
Bromobenzene	EPA 524.2	none	Detection	Quarterly***
Bromochloromethane	EPA 524.2	none	Detection	Quarterly***
Bromoform	EPA 524.2	none	Detection	Quarterly***
Bromomethane	EPA 524.2	none	Detection	Quarterly***
Butylbenzene, n-	EPA 524.2	none	Detection	Quarterly***
Butylbenzene, -sec	EPA 524.2	none	Detection	Quarterly***
Carbon Tetrachloride	EPA 524.2	0.005	Detection	Quarterly***
Chlorobenzene	EPA 524.2	0.1	Detection	Quarterly***
Chloroethane	EPA 524.2	none	Detection	Quarterly***
Chloroform	EPA 524.2	none	Detection	Quarterly***
Chloromethane	EPA 524.2	none	Detection	Quarterly***
Chlorotoluene,-o	EPA 524.2	none	Detection	Quarterly***
Chlorotoluene-p	EPA 524.2	none	Detection	Quarterly***
Dibromochloromethane	EPA 524.2	none	Detection	Quarterly***
Dibromochloropropane (DBCP)	EPA 524.2	0.0002	Detection	Quarterly***
Dibromoethane,1,2- (EDB)	EPA 524.2	0.0005	Detection	Quarterly***
Dibromomethane	EPA 524.2	none	Detection	Quarterly***
Dichlorobenzene,1,2-	EPA 524.2	0.6	Detection	Quarterly***
Dichlorobenzene,1,3-	EPA 524.2	none	Detection	Quarterly***
Dichlorobenzene,1,4-	EPA 524.2	0.075	Detection	Quarterly***
Dichlorobromomethane	EPA 524.2	none	Detection	Quarterly***
Dichlorodifluoromethane	EPA 524.2	none	Detection	Quarterly***
Dichloroethane,1,1-	EPA 524.2	none	Detection	Quarterly***
Dichloroethane,1,2-	EPA 524.2	0.005	Detection	Quarterly***
Dichloroethene,1,1-	EPA 524.2	0.007	Detection	Quarterly***
Dichloroethene,1,2,cis-	EPA 524.2	0.07	Detection	Quarterly***
Dichloroethene,1,2,trans-	EPA 524.2	0.1	Detection	Quarterly***
Dichloropropane,1,2-	EPA 524.2	0.005	Detection	Quarterly***
Dichloropropane,1,3-	EPA 524.2	none	Detection	Quarterly***
Dichloropropane,2,2-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,1,1-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,1,3 cis-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,1,3 trans-	EPA 524.2	none	Detection	Quarterly***
Dichloropropene,e,z-1,3-	EPA 524.2	none	Detection	Quarterly***
Ethylbenzene	EPA 524.2	0.7	Detection	Quarterly***
Hexachlorobutadiene	EPA 524.2	none	Detection	Quarterly***
Isodurene	EPA 524.2	none	Detection	Quarterly***
Isopropylbenzene	EPA 524.2	none	Detection	Quarterly***
Methyl tertiary butyl ether (MTBE)	EPA 524.2	none	Detection	Quarterly***
Methylene chloride	EPA 524.2	none	Detection	Quarterly***
Naphthalene	EPA 524.2	none	Detection	Quarterly***
n-Butylbenzene	EPA 524.2	none	Detection	Quarterly***
n-Propylbenzene	EPA 524.2	none	Detection	Quarterly***
Paraldehyde	EPA 524.2	none	Detection	Quarterly***
sec-Butylbenzene	EPA 524.2	none	Detection	Quarterly***
Styrene	EPA 524.2	0.1	Detection	Quarterly***
tert-Butylbenzene	EPA 524.2	none	Detection	Quarterly***
Tetrachloroethane,1,1,1,2-	EPA 524.2	none	Detection	Quarterly***
Tetrachloroethane,1,1,2,2-	EPA 524.2	none	Detection	Quarterly***
Tetrachloroethylene	*EPA 524.2*	*0.005*	*Detection*	*Quarterly****

Groundwater Sampling (cont)				
Constituent	**Analysis Method**	**Idaho Ground Water Quality Standard (mg/l unless otherwise specified)**	**Alert Level (mg/l unless otherwise specified)**	**Sampling Frequency**
Tetralin	EPA 524.2	none	Detection	Quarterly***
Toluene	EPA 524.2	1	Detection	Quarterly***
Toluene, 2-Isopropyl-	EPA 524.2	none	Detection	Quarterly***
Toluene, 4-Isopropyl-	EPA 524.2	none	Detection	Quarterly***
Trichlorobenzene,1,2,3-	EPA 524.2	none	Detection	Quarterly***
Trichlorobenzene,1,2,4-	EPA 524.2	none	Detection	Quarterly***
Trichloroethane,1,1,1-	EPA 524.2	0.07	Detection	Quarterly***
Trichloroethane,1,1,2-	EPA 524.2	0.005	Detection	Quarterly***
Trichloroethylene	EPA 524.2	0.005	Detection	Quarterly***
Trichlorofluoromethane	EPA 524.2	none	Detection	Quarterly***
Trichloropropane	EPA 524.2	none	Detection	Quarterly***
Trichloropropane,1,2,3-	EPA 524.2	none	Detection	Quarterly***
Trimethylbenzene,1,2,4-	EPA 524.2	none	Detection	Quarterly***
TRIMETHYLBENZENE,1,3,5-	EPA 524.2	none	Detection	Quarterly***
'Vinyl chloride	EPA 524.2	0.002	Detection	Quarterly***
Xylenes	EPA 524.2	10	Detection	Quarterly***

Monthly* - Assumes one (1) sample prior to the commencement of recharge activities and once a month while recharge is occurring.

Bimonthly**- Assumes one (1) sample prior to the commencement of recharge activities and if upon consultation with DEQ it is deemed a pollutant of concern, continue monitoring every other month while recharge is occurring

Quarterly** Assumes one (1) sample prior to the commencement of recharge activities and every third month while recharge is occurring.

Surface Water Sampling				
Constituent	**Analysis Method**	**NAWQS (mg/l unless otherwise specified)**	**Alert Level (mg/l unless otherwise specified)**	**Sampling Frequency**
Field Parameters				
Specific Conductance	Probe	none	na	Monthly*
pH	Probe	none	na	Monthly*
Temperature	Probe	none	na	Monthly*
Dissolved Oxygen	Probe	none	na	Monthly*
Depth to Water	Probe	none	na	Monthly*
Coliform Bacteria				
Total Coliform	SM 9221B	>0	na	Monthly*
Total Fecal Coliform	SM 9222B	>0	na	Monthly*
E.coli	SM 9223B	>0	na	Monthly*
CLPP		none	na	Upon Request
Common Ions				
Calcium	EPA 200.7	none	na	Monthly*
Sodium	EPA 200.7	none	na	Monthly*
Magnesium	EPA 200.7	none	na	Monthly*
Potassium	EPA 200.7	none	na	Monthly*
Chloride	EPA 300.0	250	na	Monthly*
Bicarbonate	EPA 310.1	none	na	Monthly*
Sulfate	EPA 300.0	250	na	Monthly*
Nutrients				
Nitrate	EPA 353.2	10	na	Monthly*
Nitrite	EPA 353.2	1	na	Monthly*
Total Phosphorus	EPA 365.1	none	na	Monthly*
Herbicides				
2,4-D	immunoassay	0.7	Detection	Monthly*
Alachlor	immunoassay	0.02	Detection	Monthly*
Aldicarb	immunoassay	none	Detection	Monthly*
Atrazine	immunoassay	0.03	Detection	Monthly*
Carbofuran	immunoassay	0.4	Detection	Monthly*
Metolachlor	immunoassay	none	Detection	Monthly*

Monthly* - Assumes one (1) sample prior to the commencement of recharge activities and once a month while recharge is occurring.

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Appendix G: Recharge Project Outline (Optional)

GROUND WATER QUALITY MONITORING OUTLINE *LAND APPLICATION OF RECHARGE WATER PROJECTS*				
OPERATOR	**Organization:**		**Contact Name:**	
Address:				
Phone:			**Email:**	
PROJECT DESCRIPTION			**PHYSICAL DESCRIPTION AND CAPACITY OF BASIN:**	
LEGAL DESCRIPTION:				
Township	Range	Section		
LAND OWNERSHIP:				**VOLUME EXPECTED:**
PROJECT PURPOSE:				
PROJECT DURATION: **Starting Date**			**Ending Date**	
RECHARGE WATER	**Origin Location:**			
Water Type:	**Conveyance System:**			
Volume:				
Attach General Site Map to include the following: Soils/Surficial Geologic, Hydrogeologic and Surface Water, and Contaminant Source/Land Use/Vegetation.				

SITE CHARACTERIZATION	
Lithology:	Hydraulic Properties:
Thickness:	

AQUIFER SYSTEM	
Areal Extent:	Thickness:
Hydraulic Conductivity:	Hydraulic Gradient:
Boundary Conditions:	Regional Ground Water Flow Direction:
	Local Ground Water Flow Direction:
Storage potential:	Natural ground water flow velocity

SPRINGS

Description	Discharge Rate	Other Pertinent Information

SURFACE WATER FEATURES

Streams (including intermittent)	Rivers	Canals	Ditches

All structures associated:	Diversions	Features

Is the recharge site within a 100-year flood plain or does it have a high potential to flood? Yes or No (If Yes please supply the following information)
Constructed berms? Where?
Imported soils? Where?
Other recharge related structures have the potential to be washed out? Where?

CONTAMINANT SOURCE, LAND USE, VEGETATION MAP AND DESCRIPTION

CONTAMINANT SOURCES

Potential Known Contaminant Sources

LAND USE

Description	Past	Present	Future Storage Potential

VEGETATIVE COVER TYPE

Species	Consumption use	Potential Impacts

WATER QUALITY MONITORING PROGRAM AND SAMPLING LOCATION MAP

Provide a baseline or ambient groundwater water quality data.

	Up-gradient	**Down-gradient**
List suggested locations to sample and monitor ground water quality. Sites should be selected based on the location with respect to ground water flow, well construction details, spring discharge, and access to the sample locations. The locations of monitoring sites should intercept all possible ground water flow directional changes caused by introducing recharge water to the aquifer.	1 2 3 4	1 2 3 4

Proposed Parameters

Name of Well	**Water Temperature**	**Specific Conductance/Total Dissolved Solids**	**Dissolved Oxygen**	**PH**

Background and/or initial ground water quality results

Major Anions		**Major Cations**	
Sulfate		Calcium	
Bicarbonate		Sodium	
Alkalinity		Potassium	
Chloride		Magnesium	
Bacteria			
Fecal Coliform		**Total Coliform**	
E. Coli			
Metals		**Nutrients**	
Arsenic		**Total Phosphorous**	
Selenium		**Nitrate + Nitrite**	
Cadmium			

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<tr><td colspan="4">Methods Used</td></tr>
<tr><td colspan="4">VOC Detections:</td></tr>
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<tr><td colspan="4">Methods Used</td></tr>
<tr><td colspan="4">Supplemental Analysis:</td></tr>
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<tr><td>First Year Project</td><td colspan="3">Yes or No If yes, skip to Recharge Water Treatment</td></tr>
<tr><th colspan="4">Continuing Projects</th></tr>
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<tr><td>Contingency Plan in place?</td><td>Yes or No</td><td>Last updated</td><td></td></tr>
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Guidance Index